RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERTATIONS IN KERALA AGRICULTURAL UNIVERSITY

MUPPIDI SPANDITHA

(2019-11-214)

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANATHAPURAM-695522

KERAL, INDIA

2022

RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERTATIONS IN KERALA AGRICULTURAL UNIVERSITY

by

MUPPIDI SPANDITHA

(2019-11-214)

THESIS

Submitted in partial fulfilment of the requirement for the degree of

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANATHAPURAM-695522

KERAL, INDIA

2022

DECLARATION

I, hereby declare that this thesis entitled **"RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERATIONS IN KERALA AGRICULTURAL UNIVERSITY"** is a bonafied record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Vellayani,

Date: 10/03/2022

Muppidi Spanditha

(2019-11-214)

CERTIFICATE

Certified that this thesis entitled **"RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERTATIONS IN KERALA AGRICULTURAL UNIVERSITY"** is a record of research work done independently by Ms. Muppidi Spanditha (2019-11-214), under my guidance and supervision and it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

Thrissur
Date: 10/03/2022

Dr. Allan Thomas
(Major Advisor, Advisory Committee)
Associate Professor and Head
Communication Centre
Kerala Agricultural University
Mannuthy, Thrissur-680651

CERTIFICATE

We, the undersigned members of the advisory committee of Ms. Muppidi Spanditha (2019-11-214), a candidate for the degree of **Master of Science in Agriculture** with major in Agricultural Extension, agree that the thesis entitled **"RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERTATIONS IN KERALA AGRICULTURAL UNIVERSITY"** may be submitted by Ms. Muppidi Spanditha, in partial fulfilment of the requirement for the degree.

Dr. Allan Thomas

(Major Advisor, Advisory Committee)
Associate Professor and Head
Communication Centre
Kerala Agricultural University,
Mannuthy, Thrissur-680651

Dr. B. Seema

(Member, Advisory Committee)
Professor and Head
Department of Agricultural Extension
College of Agriculture, Vellayani
Kerala Agricultural University-695522

Dr. Archana R. Sathyan

(Member, Advisory Committee)
Assistant Professor
Department of Agricultural Extension
College of Agriculture, Vellayani
Kerala Agricultural University-695522

Dr. Brigit Joseph

(Member, Advisory Committee)
Associate Professor and Head
Department of Agricultural Statistics
College of Agriculture, Vellayani
Kerala Agricultural University-695522

ACKNOWLEGEMENTS

I humbly bow my head before the most merciful "Lord Almighty" who through his uncountable blessings and support made this venture a success

I humbly bow my respects and thank the three pillars who unwaveringly supported me all through my crests and troughs, namely, my Father ***Muppidi Santhosh Reddy***, my Mother ***Muppidi Lalitha*** and my Chairman, ***Dr. Allan Thomas***, Associate Professor and Head, Communication Centre, Kerala Agricultural University, Thrissur. I had experienced a lot of physical, mental and emotional ups and downs during the past two years and it is because of these three pillars of strength, I have completed my master's programme. No combination of words in English language can completely express my love and gratitude towards them.

I have boundless pleasure in thanking ***Dr. B. Seema***, Professor and ADE (SZ), Department of Agricultural Extension, College of Agriculture, Vellayani, for her accurate suggestions all throughout my research work.

I wholeheartedly like to thank ***Dr. Archana R. Sathyan***, Assistant Professor, Department of Agricultural Exension, College of Agriculture, Vellayani for her valuable suggestions and remarks during the course of thesis preparation.

I am deeply thankful towards ***Dr. Brigit Joseph***, Associate Professor and Head, Department of Agricultural Statistics, College of Agriculture, Vellayani, for critically evaluating my thesis and the support she had extended at various points by improving the quality of my thesis.

I would like to extend my gratitude of thanks to ***Dr. Usha C. Thomas***, Assistant Professor, Department of Agronomy, College of Agriculture, Vellayani for her valuable suggestions and support during the course of my research.

My wholehearted thanks to the library staff and all the non-teaching staff of Department of Agricultural Extension for their unfailing support rendered during my study and research.

I deeply extend my gratitude to the authorities of Kerala Agricultural University for the financial help provided during their research.

I gratefully acknowledge my senior ***Devapriya chechi, Dhanusha chechi, Pooja chechi, Stephen cheta, Vijaykumar cheta*** for all their help, guidance and advices rendered to me.

My wholehearted thanks to my friends and classmates ***Sravani, Sailaja, Shanila, Jeena, Niranjan, Sree lekshmy, Venkat, Rupini, Geetanjali, Prassanna, Sneha, Arathy, Fathima, Reshma, Sanith*** for their kindest help and support during my study and research mentally and physically.

I would like to express my gratitude to the wonderful beings who created me, my parents, my brother ***Muppidi Dasharath Reddy***, my cousin ***Kotha Nithin reddy***, my uncles, my aunts, my grandparents and all my closest friends ***Swarna, Priyanka, Sreeja, Shivani*** *and* ***Sai Tejaswini*** for being beside me in all my ups and downs.

I deeply indebted to the teachers and PhD students who were the respondents of my study cooperated with their kind and benevolent heart and with their help I was able to complete my survey.

Muppidi Spanditha

Vellayani

Date: 10/03/2022

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

%	:	Per cent
II	:	Second
III	:	Third
A	:	Aided Private
AEDS	:	Agricultural Extension and Development Studies
AES	:	Agro- Economic Studies
AESBM	:	Agricultural Economics, Agricultural Statistics and Agribusiness Management
AEUs	:	Agro-Ecological Units
AICRP	:	All India Coordinated Research Projects/ Network Projects
AMP	:	Aromatic and Medicinal Plants
ANCOVA	:	Analysis of Co Variance
ANOVA	:	Analysis of Variance
B.Sc.	:	Bachelor of Science
BBPP	:	Biotechnology, Biochemistry and Plant Physiology
BHU	:	Banaras Hindu University
BO	:	Beneficial Organisms
BT	:	Bio-Technology
CARE	:	Consortium for Academic Research and Ethics
CBSE	:	Central Board of Secondary Education
CeRA	:	Consortium of e-Resources in Agriculture
CD ROM	:	Compact Disc Read-Only Memory
CO2	:	Carbon dioxide
COP	:	Coconut and Other Palms
CPB	:	Crop Physiology and Biochemistry
CPBI	:	Crop Pest and Beneficial Insects
CRD	:	Completely Randomized Design
DMRT	:	Duncan’s Multiple Range Test

et al.	:	and co -workers/ co –authors
etc.	:	Et-cetera
f	:	Frequency
F1 hybrid	:	First filial hybrid
FC	:	Field Crops
FGM	:	Forage and Green Manure Crops
Fig.	:	Figure
FL	:	Floriculture
FR	:	Fruits
FRC	:	Faculty Research Council
FSN	:	Food Science and Nutrition
FSRCS	:	Farming System Research and Climate Studies
G	:	Government
Gen	:	General
GS	:	Gender Studies
i.e.	:	That-is
IARI	:	Indian Agricultural Research Institute
ICAR	:	Indian Council of Agricultural Research
ICSE	:	Indian Certificate of Secondary Education
ICT	:	Information and Communication Technologies
IFS	:	Integrated Farming System
ITK	:	Indigenous Technical Knowledge
JAC	:	Journal of Applied Communications
JML	:	Journals Master List
KAU	:	Kerala Agricultural University
KVK	:	Krishi Vigyan Kendras
LSD	:	Latin Square Design
M. Ed.	:	Master of Education
M. Sc.	:	Master of Science
Max	:	Maximum
MCDB	:	Molecular, Cellular, and Developmental Biology
Min	:	Minimum

MS Excel	:	Microsoft Excel
NAAS	:	National Academy of Agricultural Sciences
NARS	:	National Agricultural Research System
NCES	:	National Centre for Education Statistics
n.d	:	No date
NRM	:	Natural Resource Management
OF	:	Organic Farming
OPAC	:	Online Public Access Catalogue
PBG	:	Plant Breeding and Genetics
PBT	:	Plant Biotechnology
PC	:	Project Coordination
PCA	:	Principal Component Analysis
PCS	:	Plantation Crops and Spices
PF	:	Pomology and Floriculture
PG	:	Post Graduate
PhD/Ph.D.	:	Doctor of Philosophy
PHT	:	Post-Harvest Technology
PI	:	Principal Investigator
POS	:	Pulses and Oilseeds
PP	:	Plant Protection
PPBM	:	Plant Pathogens and Beneficial Microbes
r	:	Correlation co-efficient
R	:	Rice
Rf	:	Restoring fertility
RBC	:	Rice and Rice Based Cropping System
RBD	:	Randomized Block Design
RC	:	Research Co-ordination
R&D	:	Research and Development
SA	:	Soils and Agronomy
SAUs	:	State Agricultural Universities
SD	:	Standard Deviation
SE	:	Standard Error

SHG	:	Self Help Group
SHOF	:	Soil Health and Organic Farming
si RNA	:	Small interfering Ribose Nucleic Acid
SPC	:	Spices and Plantation Crops
SSAC	:	Soil Science and Agricultural Chemistry
SSLC	:	Secondary School Leaving Certificate
STC	:	Sugar and Tuber Crops
UGC	:	University Grants Commission
UP	:	Unaided Private
UPGAM	:	Unweighed Pair Group method with Arithmetic Mean
URL	:	Uniform Resource Locator
USA	:	United States of America
Veg	:	Vegetables
viz.	:	Namely
WoS	:	Web of Science

Introduction

INTRODUCTION

"A sustainable agriculture is one which depletes neither the people nor the land"

~ Wendell Berry

"Research is to see what everybody else has seen, and to think what nobody else has thought"

~Albert Szent-Gyorgyi

Agriculture is a dominant sector that takes up largest part of Indian economy that provides livelihood to about fifty-eight per cent of Indian population. There is an increase in population demanding for high production of food. Though with the advent of green revolution, agriculture in India gained self-sufficiency but production is resource intensive, cereal centric and regionally biased (Pal *et al.*, 2019). With gradual decrease in resources, sustainability issue became serious prompting government to conduct research and development (R&D) plans to subdue the problems by maintaining food security and increasing productivity. According to Apurva (2016) creating new technologies or strategies increase agricultural production to which research paves the foundation. In Agriculture, planning of research should begin with a diagnosis of the current situation, which should include the need for an institution, administrative, and financial reorganisation, as well as the anticipation of political coordination of agricultural research with overall efforts toward science and technology advancement (Apurva, 2016). For conducting and coordinating such research at multi-disciplinary level, there is a need for central body in developing countries like India.

In India, there exists a public agricultural research system which is organised and managed under Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs). ICAR is responsible for aiding, promoting and coordinating agricultural education and research in India. These includes R&D systems with research laboratories, a wide network of institutions of high learning, and a cadre of highly skilled human resources (Pal et al., 2019). For this purpose, there is need to train students pursuing higher education by orienting them towards research in order to broaden the scope of research area along with diversifying production of crops, developing strategies to improve farmer's revenue thereby strengthening agricultural diversity and productivity along with ensuring food security. The agricultural research system in India includes approximately 27,500 scientists and more than one lakh supporting staff actively engaged in agricultural research, which makes it the largest and institutionally, the most complex research system in the world (Borthakur and Singh, 2012) were upper limit of higher education in India is doctoral degree. Sahay (2015) reported that in all 77,798 candidates pursued doctoral research in subjects ranging from humanities to natural sciences and from medicine to agriculture as on 2012-2015. According to recent report of Ministry of Human Resource Development (2019) in higher education; there has been double increase in number of Ph.D. scholars during research in last five years (2014-2019). Total of 41,000 students are awarded Ph.D. in 2018-2019. State universities being an integral part of the National Agricultural Research System (NARS) drives agricultural education and research. Among them with an experience of conducting over 700 research projects including 34 All India Research Co-ordinated Research Projects/ Network projects (AICRP) in the various fields of agriculture, horticulture, forestry, animal sciences and fisheries and externally aided projects funded by various national and international institutions forms a broad spectrum of opportunity for research area in Kerala Agricultural University (KAU, n.d.).

In Kerala, Agricultural College and Research Institute at Vellayani was started by Government of Travancore-Cochin in 1955. They established Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.) in Agriculture in 1961 and 1965 respectively while being affiliated under University of Kerala after formation of Kerala state in 1956. Later, it was bifurcated as Kerala Agricultural University (KAU) in accordance with the provisions of KAU Act of 1971 by taking up agricultural education, research and extension programmes on various crops or areas for research. With multi-disciplinary approach focusing on both education and problem specific research aiming at overall development of agriculture, strengthening state economy and people’s livelihood is an important part of doctoral research. This require grasping the pattern of agricultural research which facilitates identifying, scientifically documenting and publishing the contributions made through research to agrarian society. The future of agricultural education depends on developing and application of new knowledge that can be achieved by acquisition and application of new knowledge generated from research (Dyer *et al.*, 2003).

University Grants Commission (UGC) has set its footing to revive and sustain research quality and now on thesis evaluation in its insights. UGC has suggested research work to obtain the ground realities concerned with quality of doctoral thesis, to identify inconsistencies and devise remedial measures to sustain research quality to address allegations and concerns being raised globally over quality of published papers and Ph.D. theses of Indian researchers (Banchariya, 2019). Hence, this study on content analysis on research trends and academic research productivity of Ph.D. dissertations will become useful.

The study conducted by Edgar (2007) implies that this qualitative content analysis will be reckoning as it will draw attention to past, present, and future research in agricultural education *via* a holistic approach. This research work will throw light on overall contribution made through doctoral research as well as identify constraints faced by PhD scholars and teachers during conduct of doctoral research.

The detailed study on "Research trends and academic research productivity of Ph.D. dissertations in Kerala Agricultural University" was undertaken to identify the trends in doctoral research, pattern of Doctor of Philosophy (Ph.D.) studies in terms of different parameters, academic research productivity of researches, personal and social characteristics of teachers and students along with constraints faced in conducting doctoral research under following objectives:

- To assess of research pattern of Ph.D. dissertations
- To assess the productivity of the Ph.D. research in terms of proportion published or cited
- To explore the determinants of Ph.D. students' research efficiency as perceived by the teachers and study the constraints and suggestions as perceived by students and teachers in the conduct of doctoral research

1.1 PURPOSE OF STUDY

The main purpose of study was to conduct a comprehensive study on research published in all departments from 2015 to 2019 and evaluating the status of departments. These findings may reveal the broad topics of research, methodologies used and also provide an overview of prospects for future research.

The primary purpose of the study was to determine the research pattern that identifies touched and untouched areas of research as well as gaps in research. Proportion published or proportion cited that determines research productivity was also assessed. The secondary purpose of the study focuses on attributes that explore determinants of Ph.D. researcher's efficiency as well as the constraints faced during conduct of doctoral research.

1.2 LIMITATIONS OF THE STUDY

The study was limited only to the theses published during span of five years from 2015-2019 focusing on 74 doctoral theses. Due to COVID-19 situation, the study had been restricted to only one college. This could have achieved more depth if the results were compared with other colleges within university or with other similar universities. Nevertheless, with all limitations the researcher took every effort to conduct the study with reliable objectives systematically.

1.3 ORGANISATION OF THE THESES

The detailed report of the study is presented in five chapters:

The first chapter is 'introduction' and it explains about importance of topic, objectives, purpose and limitation of the study. Second chapter, 'review of literature' describes about the findings that include previous works in accordance with objective of the study. Third chapter 'methodology' designates the sampling design, the study area, measurement of content pattern main variables, academic research productivity variables, personal and social characteristics, methods of data collection and statistical tools used. Fourth chapter 'results and discussion' elucidates the results of the study with inferences. Last chapter 'summary' summarises the significant findings of the work that is done and explains the suggestions based on results of the study. At the end, the references, abstract and appendices of the thesis are provided.

Review of Literature

2. REVIEW OF LITERATURE

Literature review shows originality and relevance of research study taken up by elucidating how the proposed research is related to previous research in statistics. Overall, review of literature helps to acquire comprehensive and general context in any given field of discipline. This theoretical orientation is a criterion for any research which may have direct or indirect impact on the study. The review for this study is unique and there is only few literatures addressing this research on content analysis and academic research productivity of doctoral dissertations of State Agricultural Universities (SAUs) or others universities. Therefore, research works mainly focusing on general theme from published articles from journals or research studies on specific topics and alike which are too limited are focused upon.

The review of this study based on set forth objectives is divided under following headings:

2.1 Doctoral research in agriculture

2.2 Content analysis

2.3 Academic research productivity

2.4 Trends in PhD research

2.5 Operationalisation and measurement of content pattern of doctoral research based on different attributes

2.6 Operationalisation and measurement of different attributes of academic research productivity of PhD research studies

2.7 Operationalisation of personal and social characteristics of both students and teachers

2.8 Operationalisation of other important variables as perceived by students and teachers

2.9 Operationalisation and measurement of attitude of students towards research as perceived by students and teachers

2.10 Constraints faced by doctoral students

2.1 DOCTORAL RESEARCH IN AGRICULTURE

2.1.1 Present Scenario in India

Indian Council of Agriculture (ICAR) was established in 1929, but after India's independence, it was renamed and all federal agricultural research institutes were brought under its control. The ICAR is in charge of planning and organising agricultural research and education in the country, as well as overseeing research at deemed universities, institutions, national research centres, project directorates and national bureaus altogether accounting more than half of India's public agricultural Research and Development (R&D) expenditure and one-third of country's agricultural researchers (Pal *et al.*, 2019). Institutes under ICAR cover a broad array of categories for research namely; field crops, horticulture, natural resources, animals, fisheries and agricultural engineering.

Apart from research institutes, coordinated projects ICAR also manages State Agricultural Universities (SAUs) that has more than half of the India's public agricultural R&D researchers or scientists. But research in these SAUs is mandated in terms of state-specific research and education (Pal *et al.*, 2019).

Over the years SAUs faced budget deficit in conducting research since they have both roles of teaching and research with limited personnel and time for conducting research. Poor research infrastructure, a lack of research culture in most academic institutions, a shortage of dedicated academic researchers, and a scarcity of qualified and passionate research advisers are all obstacles that doctoral programmes in India face.

The University Grants Commission (UGC), which was created in 1953 by an act of parliament, oversees the awarding of degrees in India. Chatterjea and Moulik (2006) said that "Funding and coordination, determination, and maintenance of standards in institutions of higher education" are two of the UGC's functions. According to them there were two approaches to doctoral studies in India, one being the British-influenced Ph.D., where students start doing research from beginning (mostly commonwealth universities) while other is the American-influenced Ph.D. where students take education in general and specialized areas, qualify appropriate examinations for degree and then start research and write theses which is more prevalent in Indian universities. UGC prioritising the later approach to reduce the liabilities of idiosyncrasies of a single professor.

Sahay (2015) opined that most PhD candidates in the last 50 years or so have chosen stereotyped, repetitious, and theoretical problems. But in order to compete on a global scale, we will need to create a new kind of doctoral programme that is focused on finding long-term answers to challenges in business, industry, economics, society, and civilization.

Even though Indian agriculture research focused on diverse areas with large number of R&D laboratories, research centres and educational institutions to conduct research yet falls behind in terms of poor quality of agricultural research as no agriculture university rank high among world's top 300 universities indicating their failure in performing high quality research and train Ph.D. students. This proposes a reform in enhancing quality of doctoral research in terms of resources, facilities, financial support, academic leadership, faculty experience, incentive system of university, academic values and mandates for research that sets finest universities apart from rest as opined by Chatterjea and Moulik (2006).

2.2 CONTENT ANALYSIS

2.2.1 Meaning and concept

Content analysis meaning and concept varies from different authors. According to Nachmias and Nachmias (1976) it may be seen as a method where the content of the message forms the basis for drawing inferences and conclusions about the content. Content analysis, according to Krippendorff (1980), is a research approach for establishing reproducible and accurate inferences from data to their context. Weber (1985) defines it as a research approach that employs a series of procedures to get valid conclusions from text.

Qualitative content analysis goes beyond counting words to closely examining language in order to classify enormous volumes of text into a small number of categories that represent related meanings (Weber, 1990).

Content analysis allows an unobtrusive appraisal of texts; however, it is susceptible to the effects of research biases, which can affect decisions made in the collection, analysis and interpretation of data (Kolbe and Burnett, 1991).

Content analysis is the process of drawing reliable, repeatable and objective conclusions about a message using specific rules that follow the three main principles of scientific method: objectivity, coherency and generalizability (Prasad, 2008 and O'Leary, 2014).

2.2.2 Purpose and use of content analysis

Newcomb (1993) emphasised the need for university agricultural education programmes to be transformed, as well as the importance of adopting a new approach to agricultural education research that includes a specified programme of study. The State Agricultural Universities are in charge of research and education at the state level.

In his book "Content analysis: an introduction to its approach," Krippendorff (2004) claimed that any qualitative content approach should answer six questions: (1) What data is being examined? (2) What is the definition of the information? (3) Where is the data derived from? (4) What is the context in which this is being discussed? (5) What are the analysis limits? (6) What is to be measured, and how will it be measured?

According to Edgar (2007), the study looks at many aspects of agriculture education and proposes ways to focus on the subject. The ramifications of this study on qualitative content analysis will be significant, as it will use a holistic method to call attention to past, present and future research in agricultural education.

Zavyalova *et al.* (2012) in their study used the advanced content analysis techniques chiefly to code effective content of articles and blog entries. It has also been applied to a wide range of topics, including societal change, cultural symbols, evolving patterns in the theoretical substance of many disciplines, and so on. The main goal of content analysis in research is to uncover concepts and relationships that will aid in the interpretation of the data (Yavuz, 2016).

Hence, from above review on content analysis explains about its meaning, concept, purpose and use focusing on newness, readability and relevancy of information studied and thereby drawing inferences from different concept aspects of theses namely; subject area, empirical content and methodological concepts like objectives, research design, sample size, sampling methods, statistical methods and alike used in the doctoral theses that is to be measured in this study.

2.2.3 Methods and analysis

Classic quantitative content analysis, according to Krippendorf (1980), gives few solutions to the question of where categories come from and how the system of categories develops: "How categories are formed... is an art?" There isn't much written about it". Biswas (2009) used statistical approaches such as frequency and percentage to evaluate data in a comprehensive and meaningful way.

Khodadoost *et al.* (2011) conducted a content analysis of 37 theses using a checklist created by the investigator and utilised to explain descriptive information such as frequency, mean, percentile, tables, and diagrams. The content analysis of these theses revealed that some of the factors, such as the number of pages, the number of sources, and whether the investigators are men or women, are in the best possible position. The survey also found that the average time spent conducting research was decreasing year after year.

Preparing data, defining the unit or theme of analysis, developing categories and coding scheme, pre-testing the coding scheme on a sample, coding all the text, assessing the consistency of the coding employed, drawing inferences on the basis of coding or themes, and presenting the results are the eight steps of content analysis, according to Datt (2016).

2.3 ACADEMIC RESEARCH PRODUCTIVITY

Academic research productivity in this study was operationally defined as research output of scholars in terms of proportion published and/or cited during their course of study. The meaning, concept, purpose and use of academic research productivity varied from different authors.

2.3.1 Meaning and Concept

Typically, research productivity is measured in terms of publications (Fox, 1983 and Reynolds, 1971). As a metric of production, quantity or publications has typically trumped quality. Abdel-Ghony (1982), a researcher who specialised in academic home economists said "In a practical sense, quality is someone's subjective assessment, because there is no way of objectively evaluating or judging what is a value attribute."

Impact is a measure of a piece of research's influence, and it is determined by the number of citations it receives from other scholars. Crewe (1988) focused study on research output in politics departments at UK universities and discovered that a wide range of departmental average publication rates. Publication analysis of journal papers and books is the most common assessment of such research performance (Olson, 1994).

Universities all across the world are focusing on increasing research productivity. Graduate research programmes are a major source of research results (Belavy *et al.*, 2020).

Norris (2021) defined academic “productivity” in terms of proportion published as to the research outputs, which are generally quantified by weighted counts of academic publications in journals and books. He further explained that online publications that disseminate research findings to broader user groups via social media and blog discussion are becoming increasingly crucial for getting scientific discoveries out to governments and policymakers, local stakeholders, and the general public. The simplest fundamental technique for determining academic production output is to quantify an author's total number of publications, either over a specific time period or throughout their whole career.

2.3.2 Proportion published

The use of journal publications as a criterion for publication is an important means of communicating research findings, and this criterion is widely accepted among academic peers. Academic appointments, promotions, and other benefits all follow similar criteria (Dundar and Lewis, 1998).

Hesli and Lee (2011) defined research output in political science as the total number of refereed journal articles produced by a scholar, omitting all other types of publications such as written monographs, edited volumes or chapters and policy reports.

The National Academy of Agricultural Science (NAAS) began the process of evaluating journals because of the importance of ranking Indian journals that do not have an impact factor (Rathinasabapathy *et al.*, 2014).

According to Lakhotia (2017), the UGC standards, as updated in 2013, required at least two publications before submitting a PhD thesis. Journal publication has become a mandatory "compliance" criterion in the university system as a result of these restrictions. As a result of these regulations, the number of predatory/dubious journals that offer naive authors in the country a 'pay and publish' service has increased dramatically. The pressure on researchers to publish, on the one hand, and the lack of oversight of research quality, on the other, are two major contributors to India's current low publication rate.

The UGC-approved list of periodicals is necessary for a variety of academic purposes, including faculty appointment, performance evaluation for career promotion, and PhD thesis submission (Patwardhan *et al.*, 2018).

Databases like Scopus and Web of Science (WoS) have been extensively utilised and validated in bibliometric analysis, and their content and coverage are sufficiently transparent (Abramo and D'Angelo, 2014).

The study used Google Scholar as the h-index source since it contains a wide range of published sources and is publicly accessible in all countries. The Web of Science, on the other hand, necessitates library subscription, that might not be easily accessible in all universities in developing countries (Norris, 2021).

2.3.3 Proportion cited

Citation studies, according to Johnson (2000), disclose a lot about intellectual communication and can benefit academic libraries in establishing collections.

Citation analysis has been one of the most common ways for identifying key documents and intricate linkages between citing and cited publications for a given research community in close proximity in recent years (Thanuskodi, 2012).

Knowledge is transmitted by citations, allowing for knowledge spill over effects. As a result, citations can be used to estimate the worth of an output (Abramo and D'Angelo, 2014). According to Aksnes *et al.* (2019), citations indicate features of scientific impact and relevance.

Assessing the output of research across institutions and disciplines according to Brew and Boud (2009) was from the literature documents which includes a variety of methods for obtaining data, such as self-reporting by academics or published statistics, as well as various types of measures, such as publication counts over the researcher's lifetime or during a specific period, use of citations, types of publications counted, how dual authorship is treated, and so on.

2.4 TRENDS IN PhD RESEARCH

According to Biswas (2009), the number of theses filed at the Department of Extension Education every five years is chosen for research. It demonstrates a growing tendency in research activity undertaken in the department from 1977 to 1982-86, then a falling trend until 1992 to 96. However, from 1997 to 2001, there was another upward tendency, this time from 2002 to 2006.

According to Banateppanvar *et al.* (2013) for a period of 2000-2006 in Department of Botany from Kuvempu University, India showed that in 2006, a total of four (36.37 %) theses were submitted, followed by two (18.18 %) theses in each of the years 2003 and 2004, and one (9.09 %) thesis in each of the years 2000, 2002 and 2005 respectively.

Verma (2017) found an upward trend in research activity conducted in the department from 1980 to 1994, but a downward trend from 1995 to 1999. However, from 2000 to 2004, and again from 2010 to 2014, there is an upward trend. The most thesis was submitted in the years 2010-2014 (22.34 per cent) due to a higher number of thesis submissions during that time period, and the least research was conducted in the years 1995-99 (5.32 per cent) due to a lower number of researches undertaken during that time period. In the years 1985 to 1994 and 2005 to 2009, the average number of theses was submitted.

2.5 OPERATIONALISATION AND MEASUREMENT OF CONTENT PATTERN OF DOCTORAL RESEARCH BASED ON DIFFERENT ATTRIBUTES

Content pattern in this study was operationally defined as written text, images, and other materials that provide information about a work. It includes attributes namely; crops or areas focused, thrust areas of research, number of objectives, number of references, references based on years, types of research design, statistical methods used, sample size, types of sampling methods, independent variables and alike. Only a few reviews of literature directly connected to content pattern in doctoral theses are available from secondary sources. Hence, the review of literature has been generalised for some variables like crops or areas focused, number of references, research design, statistical methods used and independent variables.

Regarding crops or areas focused, between 1997 and 2006, the Journal of Applied Communications (JAC) identified 30 secondary research theme areas, according to Edgar (2007). Food, agriculture, natural resources, health, and family were the most often reported secondary study themes (14.30 %). The second most common secondary research theme, mentioned in 11 per cent of the research JAC publications, was information and communication technology. The third most popular secondary research topic was communication management (6.60 %).

Biswas (2009) claimed that the Department of Extension Education at Banaras Hindu University had documented 182 M. Sc. theses up to 2008, with 173 of those available in departments being used for data collecting. According to the findings, there were 18 major areas of research in the field of Extension Education, including agricultural journalism, content analysis, entrepreneurship development, environmental studies, human resource management, health studies, adoption and diffusion, ICT, social and psychological dimensions, ITK, studies of gender, developmental projects/programs, youth and children, farmer training programmes, research and educational institutions/organizations and private institutions/organizations. According to the findings, the greatest number of researchers (31.79 %) studied extension methods and communication studies, while the smallest number (1.16 %) studied entrepreneurial development.

Regarding number of objectives, Liebano *et al.* (2005) found that out of 502 doctoral dissertations examined, 146 (25.10 %) had only one objective and 376 (74.90 %) had more than one objective.

Regarding number of references, Dkhar and Thomas (2019) found that overall, there were 67 and 161 references, respectively, in the mean minimum and mean maximum and highest number of references with more than half of the references (55.93 %) were from publications published after 2001 with 27.88 % from 1976 to 2000 and 2.14 per cent from 1951 to 1975. From 1901 to 1950, a minimal fraction was taken, reflecting the researchers' inquisitive habit.

Regarding research design, Mehra and Trikha (1993) found that single research techniques were used in 75.00 per cent of 48 post-Graduate theses from seven years of research in Agricultural Communication and Extension conducted at the G.B. Pant University of Agriculture and Technology, Pantnagar from 1983 to 1989, followed by a combination of research techniques in 25.00 per cent. According to Biswas (2009), exploratory research design was utilised by the majority of theses (6.94 %), followed by ex-post-facto research design (5.78 %), and evaluatory research design was used by 3.47 per cent of theses. Only 1.73 per cent and 1.15 per cent of theses, respectively, used descriptive and experimental research methods.

Regarding statistical methods used for analysing and interpreting research results, Prolima and Kaushik (2000) found that percentages were employed for data analysis in the majority of research publications (53.50 %), followed by Mean (27.90 %), Frequency (22.90 %), Coefficient of correlation (22.30 %), t-test (19.80 %), and Chisquare (19.80 %). (16.20 %). Path analysis, cluster analysis, and other complicated statistics were rarely used in the Home Science articles. The least commonly used statistics were the coefficient of dispersion and the b value.

According to Karadag (2010), analysis of variance and covariance (ANOVA/ANCOVA) are the most commonly used statistical methods in agricultural research. Further, among 205 doctoral dissertations where statistics were used, it was discovered that 23 distinct statistical procedures were used. The most commonly utilised approaches are descriptive statistics (28.00 %), t-test (21.00 %), and ANOVA (17.00 %).

Sample size in this study is operationalised as the total number of respondents included in the theses from the entire population for examination. Regarding sample size, Thakur and Trikha (2004) observed that the most of theses (38.46 %) had range of 101-150 respondents. The highest number of respondents in a thesis was discovered to be 256, and the smallest number of respondents in a thesis was discovered to be 32.

According to Sujan (1986), the majority of studies (86.67 per cent) had 51 to 100 respondents, followed by 101 to 150 and 151 to 200. (6.67 per cent each). There was no study with a response rate of 1 to 50 per cent. Qasem (2015) found that only 25 of research calculated data on a sample of more than 500 people, while 75 % of studies collected data on a sample of 200 to 300. Because there is no set rule for the sample size of a study, most researchers utilise a practical sample size of 200 to 300.

Regarding types of sampling methods used for collecting data, Singh and Gill (1993), multistage sampling was used in practically all research projects. Random sampling was used in 60.00 per cent of the studies, followed by selective sampling in 14.67 per cent of the cases. The investigators did not specify any sampling technique in around one-tenth of the studies evaluated. In certain investigations, researchers used more than one sampling technique. Biswas (2009) found that the majority of the researchers (64.16 %) employed a random sampling approach to pick respondents, whereas 6.94 % of theses had no information regarding the sampling methods used to select respondents.

Regarding independent variables used for the social science studies, Thakur and Trikha (2004) reported that 50.00 per cent of the theses were according to the study of dependent and independent variables. Maximum number of theses (30.77 %) used variables ranging from 16 to 20 whereas 26.92 per cent used 5 to 10 variables followed by 11 to 15 variables (19.23 %), 21 to 25 variables (11.54 %), and 26 to 30 variables (3.85 %). In 7.69 per cent of the theses, more than thirty variables were used. The maximum and minimum numbers of variables used were thirty-six and eight respectively.

2.6 OPERATIONALISATION AND MEASUREMENT OF DIFFERENT ATTRIBUTES OF ACADEMIC RESEARCH PRODUCTIVITY OF PHD RESEARCH STUDIES

2.6.1 Proportion published

2.6.1.1 Number of publications

Alzahrani (2011) findings showed one to three publications was most common number of publications followed by 4 to 8 publications.

According to Laband (2013), most referenced economics articles belong between 2001 and 2005 period and were published in 58 diverse journals. Furthermore, journals are used as proxies for determining the quality of a paper.

Larivière (2013) stated that although alternative bibliographic sources, such as Scopus and Google Scholar, can be utilised for bibliometric analysis, the Web of Science (WoS) remains the most consistent source. It was found that among the publications published by students from 2001 to 2007, under natural sciences 55.00 per cent published at least one paper with two (2) average number of papers from each student.

2.6.1.2 Publications in peer reviewed journals

Altbach (2015) found that in the competitive atmosphere of global higher education, publication in high-status refereed journals has become a major criteria of academic achievement. It is highly prestigious to be published in internationally disseminated English-language journals. Journals that are indexed in major global indices, such as the Science Citation Index, Web of Science, or Scopus, or their equivalents for other fields, are counted in worldwide rankings.

2.6.1.2.1 Indices used for measurement

Regarding NAAS rating, Rajagopal and Rameshkumar (2005) discovered that Indian journals need to improve their publication quality because most of the papers they publish aren't up to international standards by looking at their NAAS ratings. They emphasised the need to improve the quality of scientific journals published in India. According to Bishwapati *et al.* (2012), NAAS is the only academy in India that serves to agricultural professionals, and it must play an active role in raising the standards of publication in the field of agricultural research and development.

In terms of UGC care list, the study conducted by Patwardhan *et al.* (2018) reflected that out of 1009 journals analysed according to UGC protocol showed that only 112 (11.1 %) were qualified to publish.

Regarding the Copernicus index, Barczynski and Rek (2011) study explained that every year the Index Copernicus scientific system assesses scientific journals from around the world and publishes the results on the Index Copernicus Journals Master List (JML) platform. JML's fundamental function is to rate journals based on over 100 evaluation criteria that take into account international editorial standards. Scientific quality, editorial quality, international availability, frequency-regularity-stability, and technological quality are the factors used by the JML module to evaluate journals. The Index Copernicus system's rating is used to prepare journals for review in the Index Medicus/Medline, Scopus, and Thomson Reuters databases. The criteria for journal evaluation allow for a more efficient inclusion of many local publications in worldwide circulation.

Regarding google scholar, Larivière (2013) believed that although Google Scholar indexes a bigger fraction of current literature than the Web of Science (WoS), its coverage of older records is less, and it is impractical to utilise for large-scale studies from a practical standpoint.

2.6.2 Proportion cited

2.6.2.1 Bibliographic form wise distribution of citations

Regarding chronological distribution of citations, findings of citation analysis conducted by Hiremath and Sangen (1988) of PhD dissertations in Chemistry showed that more than 89 percent of the citations were less than 29 years old. Kittur (2017) showed that the most cited publications are those published between 1981 and 1990, with 2216 citations. Publications published between 1991 and 2000 came in second.

Regarding source of citations distribution, study conducted by Yeap and Kaur (2008) for five years from 2000 to 2005, the most commonly used literature in the writing of dissertations by graduate students has been journals (49.90 %) followed by books (18.84 %), electronic media (9.54 %), theses and dissertations (8.76 %) and other categories namely proceedings, reports, government publications, newspapers, abstracts and alike collectively accounted for 12.00 per cent of citations.

Banateppanvar *et al.* (2013) study reflected that the largest percentage of citations come from journals, accounting for 74.77 per cent of all citations followed by books (16.20 %), proceedings/ seminars (4.48 %), theses and dissertations (2.58 %) and reports (1.15 %) from department of Botany. According to study piloted by Kittur (2017) reflected that out of 7498 citations, 5667 citations were from journals followed by books (718), proceedings (409), Master of Science (M.Sc.) theses (196), newsletter (113), Doctor of Philosophy (Ph.D.) theses (91) and remaining citations (304) were from annual report, report, abstracts, e- resources, monographs, yearbook, research report, handbook, government publications, paper, manual, encyclopaedia newspaper, lecture notes, statistics *etc.*

2.6.2.2 Geographic distribution of citations

Regarding geographic distribution of citations, Hiermath and Sangen (1988) found that 56.00 per cent of citations were from United States of America (USA). Vimala (1997) study stated that the researchers in Biological Sciences substantially cited material produced in the United States, the United Kingdom, and India accounting

80.00 per cent, according to the country-wise distribution of citations in Biological Sciences.

In case of study conducted by Doraswamy and Pulla Reddy (2005) shown that India ranked highest with 32.41 per cent of total citations, followed by the United States (8.63 per cent), and the United Kingdom (7.64 %). While study from Kittur (2017) revealed that India is highest in terms of the number of citations, with 36.90 % of all citations coming from India. The second-placed country, the United States, covers 28.03 per cent of citations, while the third-placed country, the United Kingdom, covers 8.52 per cent.

2.6.2.3 Average number of citations per dissertation

Regarding average number of citations, Kuruppu and Moore (2008) citation analysis of doctoral studies from different departments showed that in the Molecular, Cellular, And Developmental Biology (MCDB), microbiology, genetics, and plant physiology disciplines, the average number of journal citations per dissertation ranged from 191.40 to 213.40, while in plant pathology, entomology, plant breeding, and soil science, the average number of journal citations per dissertation ranged from 93.00 to 157.50.

Banateppanvar *et al.* (2013) observed that on an average 253.63 citations were cited per thesis and highest number of citations per thesis was 329 and lowest average number of citations was 160 cited by botany research scholars.

From study by Kittur (2017) it was found that average number of citations per thesis was 208 with highest average citations per thesis was during period 2000 to 2003 publications. Malekmohammadi (2017) stated that average number of citations per dissertation was 152.40 with highest citations from periodicals (55.64 %).

2.7 OPERATIONALISATION OF PERSONAL AND SOCIAL CHARACTERISTICS OF BOTH STUDENTS AND TEACHERS

2.7.1 Age of both students and teachers

Age in this study was operationally defined as number of years completed by respondent at the time of investigation. Samantha (1985) found that the majority of the scientists (70.27 %) were in the 40to 50 age group. According to Ardeshana (1990), the majority of professors (64.62 per cent) were in the medium age category (36 to 50 years), followed by the young age group (21.54 %) and the old age group (13.84 %). Furthermore, 86.16 per cent of teachers are in the youthful and middle-aged demographic.

According to Nagpal and Mukhopadhyay (2012), majority (43.30 %) of doctoral students belonged to age group 35 to 45 followed by age group above 45 (36.70 %) and age group of 25 to 35 with 20.00 per cent. As per study conducted by Natekar (2013), 62.00 per cent of the respondents are between the ages of 25 and 30.

According to National Centre for Education Statistics (NCES) data from various years the average age of graduate students at the time of completion of their degree was 32.40 years old (as of December 31, 2007) and 49.00 per cent students belonged to age group 29 and below during 2008 followed by 28.00 per cent from 30 to 39 age group and 22.00 per cent belonged to age group 40 and above (NCES, 2018). It is also predicted that in coming years the average age of students who completed the doctoral degree may decrease.

2.7.2 Gender of both students and teachers

Gender in this study refers to biological distinction of respondents as either male or female. Pyhältö *et al.* (2012) expressed that in this study 74.14 % females were enrolled in doctoral degree while there were only 25.26 % males. Natekar (2013) study indicated that most of the respondents were females with 57.00 per cent and only 43.00 per cent were males.

University Grants Commission (2019) report showed that the female Ph.D. awardees increased at faster rate (9.35 % per annum) than male doctorate awardees (5.86 % per annum) indicating lessening of gap between both genders at doctorate level. According to Sabbah (2020) , majority of the doctoral students were female (78.90 %) and rest were males (21.10 %).

2.7.3 Locality of students

Locality here in this study refers to the city, town or village that respondents are native to. According to Kumar *et al.* (2010) 54.25 per cent belonged to rural areas and remaining 45.75 per cent were from urban area.

Nathalal *et al.* (2015) study showed that majority (67.45 %) of the respondents were from urban areas and rest 32.55 per cent from rural area.

2.7.4 Educational background of students

Educational background in this study refers to the education the students have undergone beginning from kindergarten and ending with Master's or Ph.D. degree. Ramos *et al.* (2012) study reflected that about 70.00 % of schools are located in metropolitan regions, and the majority of them are public, although the ratio of public schools in rural areas (over 90.00 %) is substantially larger than in urban areas indicating more students are studying in public school.

In the paper published by Kumar *et al.* (2017) titled "To study the residential background and performance of agriculture students in academics" opined that students in rural areas should have performed better than those in metropolitan areas. The results, on the other hand, were exactly the reverse which can be explained from the findings of Shukul (1981) that urban students performed better than from rural areas in agriculture not because of the effect of residence but because of difference in proficiency in English as students from urban areas generally come from English medium school while rural students from vernacular medium of instruction and later join English medium directly.

2.7.5 Parental annual income of students

Parental annual income in this study refers to income in rupees earned by student's parents annually. Glocker (2011) expressed that doctoral students with good financial background can afford the expenses of their research by using their own or their parents' money. This option is not available to students from low-income families. Such students could only meet their expenditures by working in an environment where financing is restricted and there is no effective student aid system.

In the findings of study conducted by Nathalal *et al.* (2015), the students were divided into three categories based on their parents annual revenue *viz.* lower income group (up to 2.00 lakh), medium income group (2.01 to 4.00 lakh), and higher annual income group (beyond 4.00 lakh). The medium annual income group accounted for over 63.48 per cent of all enrolees, followed by the higher annual income group (27.90 %) and the lower annual income group (8.62 %).

2.7.6 Research Skill of students

Research skill in this study refers to as ability to search for, locate, extract, evaluate and use of present information that is relevant to a particular topic. Six types of research skills are evaluated namely, information seeking skills, methodology skills, problem solving skills, statistical/analytical skills, communication skills and universal outcomes required for the doctoral student to conduct research.

Information seeking skills refers to as ability to search, use, and evaluate information. According to Fidzani (1998), most graduate students lack sufficient abilities in accessing the library and its resources productively. Barrett (2005) study results indicated that graduate students use electronic information technology on a regular basis, and they frequently use generic Internet search engines to find general information on a topic. During the early years of their programmes, students lack personal collections and extensive subject experience in the subjects they are researching.

Methodology skills means identifying and designing appropriate research procedure, understanding the limitations and scope of research study. Methodological understanding, information seeking skill and oral communication skills are among the research skills in which graduate students reported the biggest improvement over the course of an academic year as for study conducted by Gilmore and Feldon (2010). Meerah *et al.* (2012) study showed that graduate students possessed good level of methodology skills.

Problem solving skills refers to ability of students to identify, define and analyse problems, to create solutions and evaluate them and to choose the best solution for a particular context. Moorthy (2018) stated through his study that students possessed and average level of problem solving skill on the whole. Franestian *et al.* (2020) opined that students' responses are either vague or limited to general knowledge and experience demonstrating that students' awareness of possible solutions to the problem is still limited. Learning can help you improve your problem-solving skills by helping you understand concepts and facts.

Statistical or analytical skills define the ability of researchers to carry out data collection and analysing procedure besides understanding them. According to study conducted by Ghulami *et al.* (2015) concluded that students have put in a considerable time and effort to learn statistics or analytical analysis but they believe that this course is extremely tough, that it is irrelevant to their daily lives and that it necessitates a significant amount of effort. Saidi and Siew (2018) opined that understanding statistical measures is unlike from understanding statistical mechanics, which entails entering numbers into the appropriate formula.

Communications skills of students for research refers to ability to write and present the research and its findings whereas universal outcomes refer to general skills necessary for researcher in conducting the research. Scholars believe that ineffective communication is the root of many issues, hence communication is the answer to many problems (Pearson and Nelson, 2000).

2.7.7 Educational qualifications of teachers

Education in this study is operationalised as to extent of formal education possessed by respondent at the time of survey. Murnane and Phillips (1981) discovered a positive correlation between teacher effectiveness and years of experience, but the connection is not always substantial or linear.

There is a link between teacher competence and educational qualification. Individuals with a higher education were competent in diverse jobs as adult education teachers (Reddy, 1980). According to Samanta (1985), the majority of teachers had a high educational status. She discovered that 43.20 percent of the teachers held a doctorate degree. Majority of professors (53.85%) had a master's degree and 46.15 percent had a doctorate indicating that that there was a positive but non-significant link between education and professors' attitudes toward teaching (Ardeshana, 1990).

Educational assessment, according to James (2009), is a professional duty for teaching staff that stems from a desire to understand the effects of instruction on students and to improve the quality of education.

2.8 OPERATIONALISATION OF OTHER IMPORTANT VARIABLES AS PERCEIVED BY STUDENTS AND TEACHERS

2.8.1 Outcomes of research

The other important variables that may influence researcher's study to derive effective outcomes from research are studied under following headings:

2.8.1.1 Resource availability

Resource availability refers to the availability of literature, research materials, raw materials and for the purpose of conducting research. According to Patel (1992), the majority of respondents (55.00 %) believe that a funding is adequate for the procurement of research materials whereas 45.00 % of respondents believed that the funds were insufficient. In terms of research facilities, 68.33 % of respondents thought they were moderately accessible. However, 18.33 and 13.34 per cent of respondents, respectively, reported a poor and high level of availability of research facilities.

Alzahrani (2011) reported that lack of information resources and financial support for the field of research as the barriers for conducting research. Akareem and Hossain (2016) opined that that students who receive a scholarship usually set a high standard for quality education and are found to be in higher expectation groups than those who do not receive a scholarship.

2.8.1.2 Resource attainment difficulty

Resource attainment difficulty in this study refers to the difficulty in attaining the literature, research materials, raw materials and funds for conducting research. According to findings from study conducted by Gruszczynska (2016), during early years of research researcher's often see themselves cut off from sources of assistance (networking, professional growth, or career counselling) just when they needed most. Dkhar (2019) study showed that 61.67 per cent students faced difficulty in attaining resources may be because of untimely disbursement of funds and procurement of raw materials and research materials not made accessible on time.

2.8.1.3 Acquaintance support as perceived by students

Acquaintance support in this study was operationally defined as extent of help the students are receiving from his/her friends or peers, major advisor, advisory committee members, non-advisory members, own department and other department. According to the findings of Shelton (2003), students who reported greater perceived faculty support were more likely to continue in the degree than students who withdrew either voluntarily or due to academic failure.

Drake (2011) proposed that, while academic advising has long been recognised as critical to student success, persistence, and retention, it also involves "building relationships with our students, locating places where they become disconnected, and assisting them in becoming reconnected." According to Natekar (2013), 70 per cent of respondents consulted their guide to assist them choose their research topic, while 30.00 % decided their topic on their own.

2.8.1.4 Publishing difficulty

Publishing difficulty in this study refers to the difficulty faced by the students while giving the papers for publishing in journals. Stoilescu and McDougall (2010) suggested that although high refereed scholarly journals are always favoured, doctoral students should pay close attention to learn about the realistic odds of being accepted, as well as the amount of time it takes to submit and pass each stage of the submission process in order to be accepted in these peer-reviewed journals. These journals have a high rate of rejection (typically 90.00 to 95.00 per cent), and some students may fall into this group due to a lack of experience. Natekar (2013) findings indicated that only 60.00 % of respondents have published articles in prestigious journals.

2.8.1.5 Research work environment

Research work environment refers to the surrounding conditions in which the researchers work. Research takes place in a setting that can either hinder or encourage the emergence of new ideas and knowledge generation (Fox, 1992). Gilmer (1966) discovered that the environment has an impact not just on human behaviour but also on how organisations interact.

Falk *et al.* (2019) through his study opined that though doctoral students thought their work was challenging, but the versatility in the working process or environment compensated for it.

Aboagye *et al.* (2021) described in his study on "Investigating the association between publication performance and the work environment of university research academics: a systematic review" that the research is carried out within the context of organisational practises and policies, but it also largely relies on the work environment. In general, the work environment encompasses organisational and psychosocial characteristics, as well as ergonomic factors (e.g., laboratory environment and office space).

2.8.1.6 Researcher satisfaction

Researcher's satisfaction refers to short term attitude resulting from an evaluation of students' educational experience, services and facilities. student's satisfaction is defined by his or her degree of pleasure as well as the efficiency of the instruction received (Ali and Ahmad, 2011).

According to Husemann *et al.* (2017), about 88.00 per cent of respondents expressed they were satisfied to very satisfied after publishing their work.

2.8.2 Gaps in research themes

Gap in this study was operationally defined as breach between the research themes framed by university and the students and teachers' perception about their adequacy regarding those research themes irrespective of the department they belonged.

Cochrane & Adem (2017) through their study concluded that though emerging research is filling gaps in research in terms of systematic reviews of literature about what is known rather than what is missing like trends in research and inspiring innovations.

Dkhar (2019) study regarding gaps in post graduate research themes indicated that all departments showed there was less than 50.00 per cent gap in research themes adequacy as perceived by teachers except Department of Microbiology (80.00 %) and suggested removing untouched themes by incorporating new areas of research based on trends in agriculture.

2.9 OPERATIONALISATION AND MEASUREMENT OF ATTITUDE OF STUDENTS TOWARDS RESEARCH

Attitude towards research in this study refers to the positive or negative mental predisposition of the students towards research. Based on the research conducted by Jalihal (1970) on the concept and role of agricultural universities in India, reported that students showed positive attitude about the new educational framework.

According to Papanastasiou (2005), master's students had more positive ideas and were more serious about research work because it could aid them in their future professional career.

Nathalal *et al.* (2015) findings showed that majority (80.00 %) of the students possessed highly favourable attitude followed by 11.51 per cent with medium level and 8.49 per cent with less favourable attitude towards education.

In their study, Siamian *et al.* (2015) found that students had good opinions toward the usefulness of employment and career search, anxiety, relationship with everyday life, and research challenge. The data revealed that there was no substantial variation in students' attitudes about research based on their age, gender, or educational level.

Students who were exposed to more scientific research had a more favourable opinion toward it (Seher, 2018). With regard to it when comparing the attitudes of Master's and Doctoral students toward research, it was found that Doctoral students have a more positive attitude toward research than Master's students (Abun *et al.*, 2019). Findings of Boppana (2019) concluded that 58.00 per cent of students have a positive attitude toward research, while the rest (42.00 %) have the most favourable attitude.

2.10 CONSTRAINTS FACED BY DOCTORAL STUDENTS

Several elements have been recognised as stumbling blocks to a student's PhD experience, including financial and resource constraints, challenging disciplines, information accessibility, and progress tracking (Wao and Onwuegbuzie, 2011; Neumann, 2012).

Pyhältö *et al.* (2012) found that doctorate students' perceptions of the issues they faced during their studies differed. These issues were specifically related to general working procedures (31.00 %), domain-specific knowledge (29.00 %), supervision and the scholarly community (21.00 %) and resources (19.00 %).

Coping with changes or alterations in research, post-doctorate blues, and personal life changes, lack of access to resources, lack of support from supervisors, time management, maintaining writing productivity, and uncertainties about academic careers, identity crises, and career issues are among the common challenges faced by researchers in the beginning, according to Gruszczynska (2016).

Methodology

METHODOLOGY

This chapter expounds on research methods and procedures adopted in conducting the present research study in line with objectives set forth for this study. The methodological details used were given under the following section heads:

3.1 Research design

3.2 Locale of study

3.3 Selection of thesis

3.4 Selection of respondents

3.5 Trends in PhD research

3.6 Operationalization and measurement of content patterns for doctoral research studies in terms of different attributes

3.7 Operationalization and measurement of academic research productivity for doctoral studies in terms of various attributes

3.8 Operationalization of personal and social characteristics of students and teachers

3.9 Operationalization of other variables as perceived by both students and teachers

3.10 Operationalization and measurement of attitude of students towards research as perceived both by students and teachers

3.11 Constraints as perceived by students and teachers during the conduct of PhD research

3.12 Suggestions for improvement

3.13 Data collection procedure

3.14 Statistical methods used in the study

3.15 Hypothesis set up for the study

3.1 RESEARCH DESIGN

Research design is the framework of research methods and techniques chosen by researcher to solve the problems of research. With the set forth objectives, qualitative content analysis was conducted for studying different attributes of doctoral research in agriculture. An '*ex post-facto*' design has also been followed for studying the themes of research for obtaining data from the respondents. It is a study where researcher tries to determine the cause behind such event or phenomena with probable contributing factors.

3.2 LOCALE OF STUDY

College of Agriculture, Vellayani campus of Kerala Agricultural University was selected as location of study. Map showing the area of study is illustrated in fig.1.

3.3 SELECTION OF THESIS

The entire PhD theses submitted to College of Agriculture, Vellayani for the five years from 2015-2019 were enumerated, categorized and subjected to qualitative content analysis under different departments and divisions. Under each division the theses were categorised department wise. The selection of thesis is presented in fig.2.

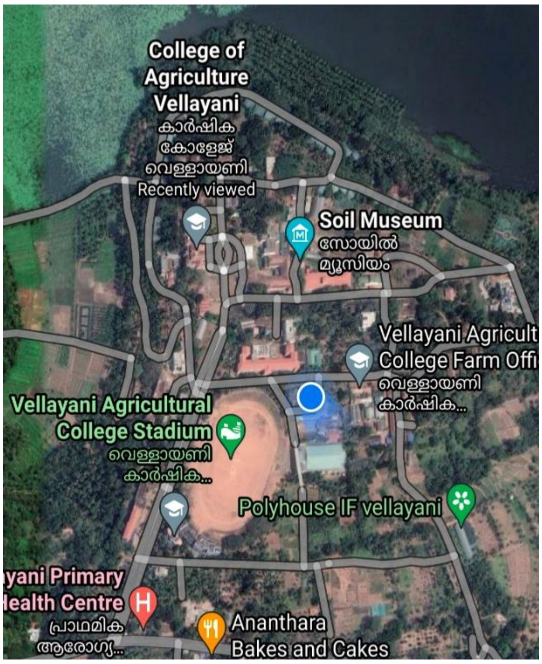
3.4 SELECTION OF RESPONDENTS

The respondent groups of the study include 30 teachers selected randomly who has guided or is guiding students at the time of data collection and 50 PhD students of College of Agriculture, Vellayani, Kerala wherein the selection was again done using simple random sampling technique. The Ph.D. students were selected from II year and III year as on 2020-2021. Thus, the total sample size was comprised of 80 respondents with 30 teachers and 50 Ph.D. students as presented in fig.3.

3.5 TRENDS IN PhD RESEARCH

With respect to objectives set for the study in order to determine trends in PhD research, data has been collected personally from the library and Research Coordination (RC) office. The theses were categorised and tabulated based on the following subheadings:

Source: https://wiki.meramaal.com/



Source: www.googlemaps.com

Source: www.google.com

Fig. 1 Location map of study area

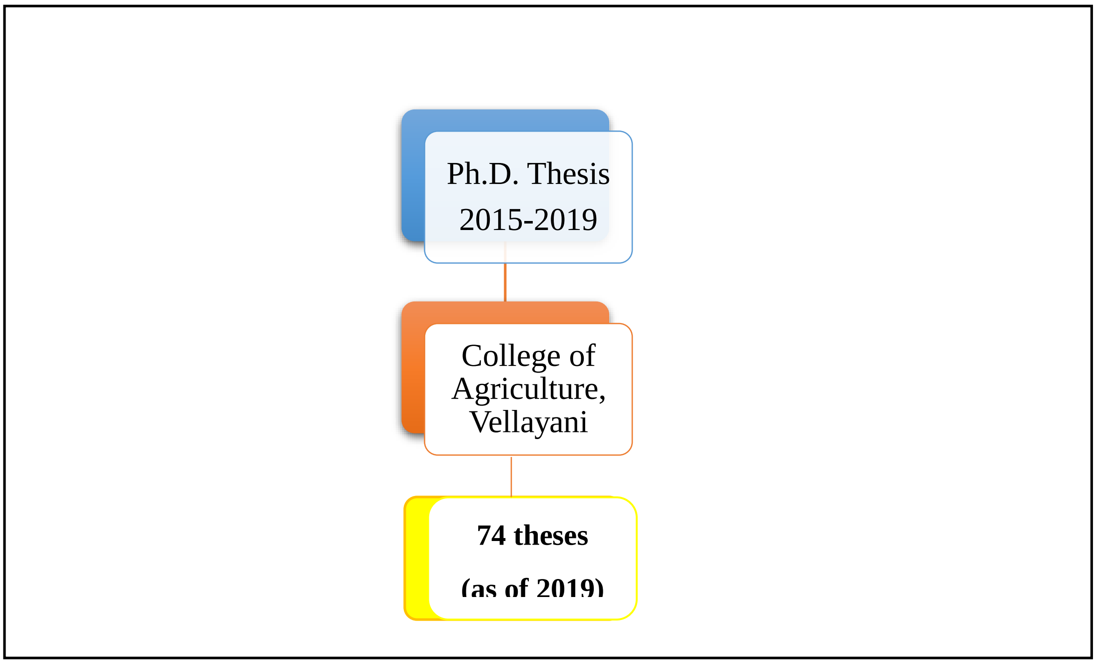


Fig. 2 Selection of thesis

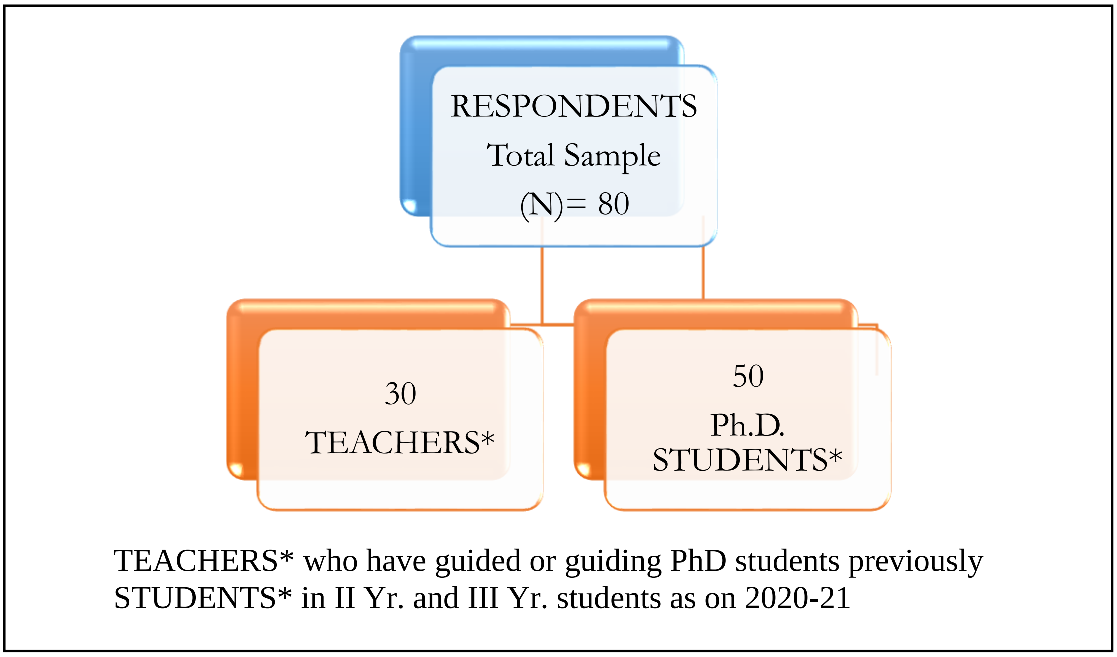


Fig.3 Selection of Respondents

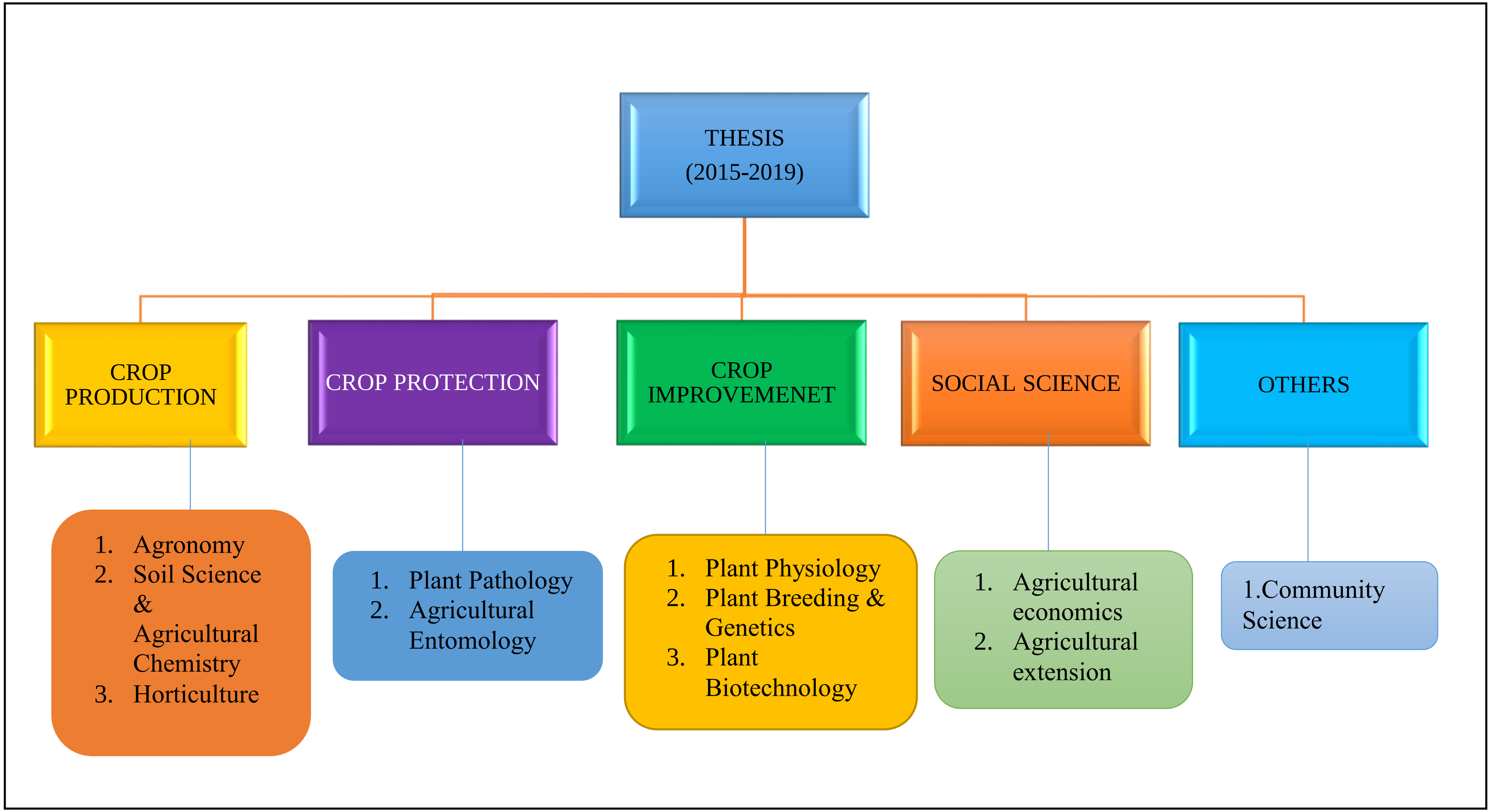


Fig. 4 Framework for selection of thesis

3.5.1 Number of theses published per year

3.5.2 Year wise categorisation of theses under each division

3.5.1 Number of theses published per year

The trends of the PhD research have been totalled and categorised based on number of theses published from 2015 to 2019 in fourteen departments *viz.* Department of Agronomy, Soil Science and Agricultural Chemistry (SSAC), Vegetable Science, Pomology and Floriculture (PF), Plantation Crops and Spices (PCS), Post-Harvest Technology (PHT), Plant Physiology, Plant Breeding and Genetics (PBG), Plant Biotechnology (PBT), Agricultural Extension, Agricultural Economics and Community Science. Department of Vegetable Science, Pomology and Floriculture (PF), Plantation and Spices (PCS), Post-Harvest Technology (PHT) were put together as Horticulture. The number of theses submitted each year was tabulated and expressed in terms of frequency and percentages. The list of theses under each department along with their PC groups is presented in appendix I.

3.5.2 Year wise categorisation of theses under each division

The total number of theses submitted from 2015 to 2019 were categorised into five divisions namely, crop production, crop protection, crop improvement, social science and community science and trends have been observed. Year wise categorisation of theses under each division was expressed in terms of frequency and percentage. The framework for selection of thesis was illustrated in fig.4.

3.6 OPERATIONALIZATION AND MEASUREMENT OF CONTENT PATTERNS FOR DOCTORAL RESEARCH STUDIES IN TERMS OF DIFFERENT ATTRIBUTES

A total of ‘nine’ attributes (3.6.1 to 3.6.9) were selected in general for the study of content pattern of the research studies in all departments under different divisions whereas ‘one’ more attribute (3.6.10) was selected for the theses belonging to social science division. The attributes are mentioned as below:

3.6.1 Crops or area focused

3.6.2 Thrust areas of research

3.6.3 Number of objectives

3.6.4 Number of references

3.6.5 References based on years

3.6.6 Type of research design

3.6.7 Statistical methods used

3.6.8 Sample size

3.6.9 Types of sampling method

3.6.10 Number of independent variables

3.6.1 Crops or areas focused

Crops or areas focused refers to the different types of crops considered for the study or different areas of study other than crops that have been focused upon by researchers. Crops or areas under study were carefully listed and expressed in terms of frequency and percentage under each division.

3.6.2 Thrust areas of research

Thrust areas of research in this study refers to different areas of study other than crops that have been focused upon by the students or based on research themes framed by university. According to "Project Co-ordination Groups, Thrust Areas and Project Bank" handbook published by Directorate of Research, Kerala Agricultural University, research thrust areas selected were from 2011 to 2017. There were reforms in thrust areas and PC groups with add-ons and omissions over the years. So, for the convenience they were divided into two periods from 2011 to 2014 and 2015 to 2017 as illustrated in fig.5. This can be further understood with categorisation under following sub-headings:

3.6.2.1 Categorisation of touched and untouched thrust areas under each PC groups

3.6.2.2 Thrust areas of PhD research under each PC group

3.6.2.1 Categorisation of Touched and Untouched Thrust Areas under each PC groups

List of all the PC groups and thrust areas provided for periods 2011 to 2014 and 2015 to 2017 were illustrated in appendix II which were recorded during Faculty Council Report (FRC) for the technical programmes of research works submitted

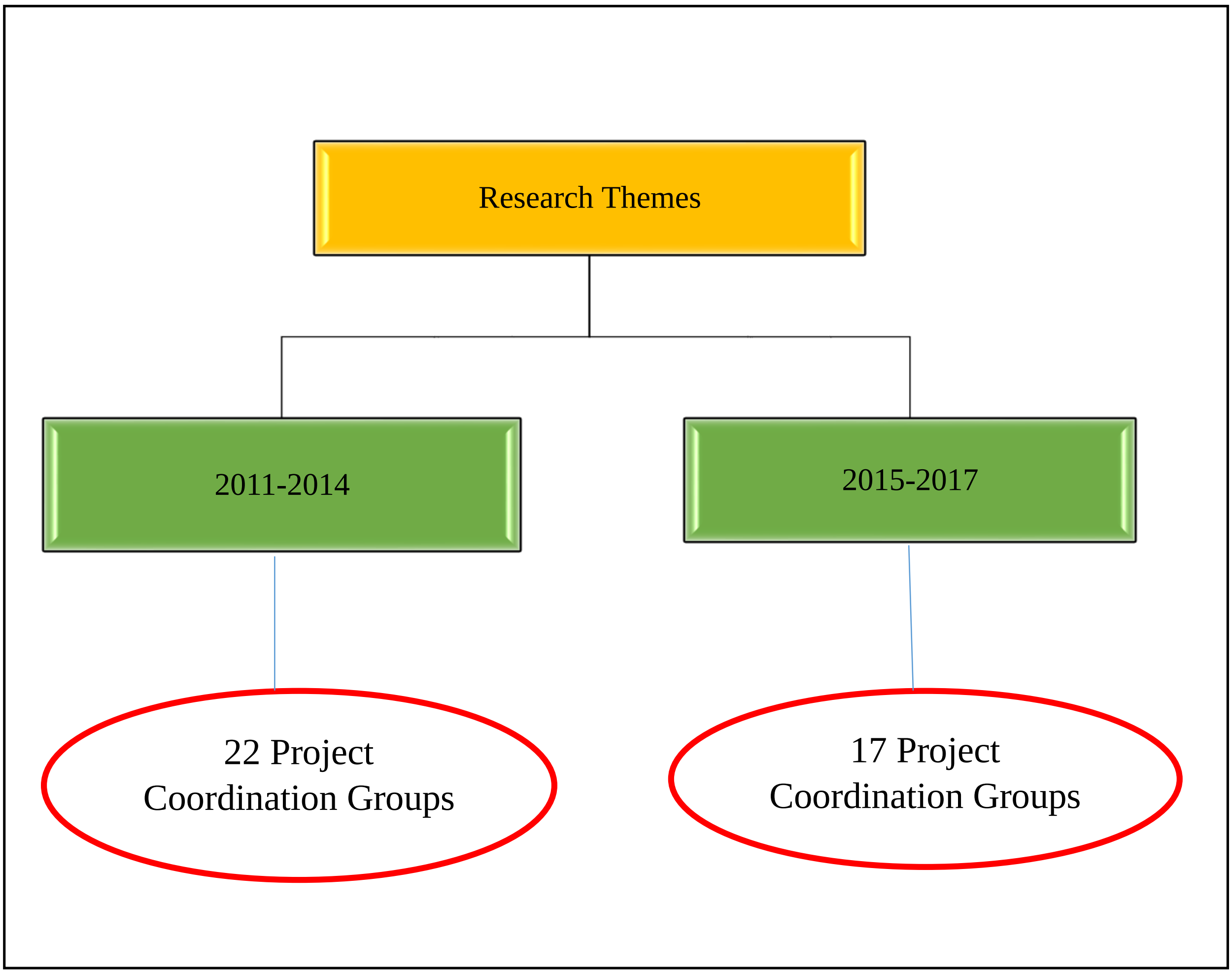


Fig.5 Framework for selection of research themes

during period from 2015-2019. The thrust areas which were touched and untouched among those were explored, categorised and expressed in terms of frequency and percentage.

3.6.2.2 Thrust areas of PhD research under each PC group

The thrust areas indicating the research themes studied for research works submitted from 2015-2019 were recorded from FRC report and analysed. These were tabulated for two periods *viz.* 2011-2014 and 2015-2017 and the maximum number of theses under each of those thrust areas were calculated and presented.

3.6.3 Number of objectives

Objectives in this study was operationally defined as research objectives that were proposed for the research. Through these objectives researchers achieve the final results of the study. The number of objectives mentioned in the theses were counted from each thesis. The number of objectives under each division theses were computed based on quartiles and categorised into low, medium and high objectives. These were expressed in frequency and percentage. A summarisation of all theses with respect to number of objectives in each thesis is categorised and expressed in terms of frequency and percentage.

Category	Criteria
Low	<Q1
Medium	Between Q1 and Q3
High	>Q3

3.6.4 Number of references

References in this study was operationally defined as the record of all sources from which the researchers gained information to support the study which is included in the last pages of the thesis. Number of references in each thesis were counted and totalled manually. Department wise theses under each division were categorised into low, medium and high using mean and standard deviation as check. They were expressed in frequency and percentage. Furthermore, mean number of references of the theses under each division was computed and results were illustrated as box plot using quartiles as check.

Category	Criteria
Low	<Q1
Medium	Between Q1 and Q3
High	>Q3

3.6.5 References based on years

It refers to year in which all the sources of references were published. The references were counted and categorised based on year of publication and their frequency and percentage under each category was calculated as mentioned below:

Sl.No.	Category	Frequency
1	Before 1900	
2	1900-1925	
3	1926-1950	
4	1951-1975	
5	1976-2000	
6	Above 2000	

Range=25

3.6.6 Types of research design

Research design in this study refers to as set of procedures or measures used in collecting and analysing data of different attributes in the problem research which turns conceptual research into empirical one. Different types of research designs were identified by examining each thesis and categorised under each department division wise. The frequency and percentage of the results were presented.

3.6.7 Statistical methods used

Statistical methods in this study refers to various statistical tools and techniques used to analyse raw research by extracting information and providing ways to assess the data. Different statistical methods were identified from all the theses and classified as basic statistics, genetics based statistics, grouping/clustering type analysis, multivariate analysis, non-parametric tests and methods, parametric tests and methods and regression analysis. Based on this classification, statistical methods in each thesis were categorised department wise and presented under each division. The results were expressed in terms of frequency and percentage. The detailed classification is presented in appendix III.

3.6.8 Sample size

Sample size in this study refers to as number of respondents as in survey studies or number of treatments with replications in case of field, laboratory, pot culture or greenhouse experiments are selected for the study. Total sample size from each thesis was calculated, categorised based on range and articulated in terms of frequency and percentage for each department under each division.

Sl.No.	Sample size range
1	Less than 100
2	101-200
3	201-300
4	301-400
5	Greater than 400

Range=100

3.6.9 Types of sampling methods

Sampling methods in this study was defined as the method used to select a representative sample (group) from the population to collect data under the study. The sampling methods from studies that include population were identified and categorised and expressed as frequency and percentage under each division.

3.6.10 Number of independent variables

Independent variables refer to the variables that are stable and unaffected by other variables. The number of independent variables indicated in social science theses are recorded. The frequency and percentage was calculated using mean and standard deviation as check and categorised as low, medium and high.

3.7 OPERATIONALIZATION AND MEASUREMENT OF ACADEMIC RESEARCH PRODUCTIVITY FOR DOCTORAL STUDIES IN TERMS OF VARIOUS ATTRIBUTES

A total of 'five' attributes were divided into two parts as proportion published (3.7.1.1- 3.7.1.2) and proportion cited (3.7.2.1-3.7.2.3) for studying about academic research productivity of all research studies from all departments. The variables studied were listed in following sub-headings:

3.7.1 Proportion published

3.7.1.1 Number of publications

3.7.1.2 Publications in peer reviewed journals

3.7.2 Proportion cited

3.7.2.1 Bibliographic form wise distribution of citations

3.7.2.1.1 Based on year

3.7.2.1.2 Based on source

3.7.2.2 Geographic distribution of citations

3.7.2.3 Average number of citations

3.7.1 Proportion Published

3.7.1.1 Number of publications

Number of publications in this study refer to total number of publications published by researcher during course of study. The publications were identified with help of annual publications report published by university, Google scholar, Research

Gate or other sources available from internet. The results were categorised into below mean and above mean based on mean number of publications as check and expressed with frequency and percentage under each division

3.7.1.2 Publications in peer reviewed journals

This was operationally defined as number of articles published in peer reviewed journals that are listed in National Academy of Agricultural Sciences (NAAS) rated journals, University Grants Commission (UGC)-Consortium for Academic Research and Ethics (CARE) list, Copernicus index, Scopus index, Google scholar and other similar measurements. The publications identified were categorised based on different indices under each division. They were expressed in terms of frequency and percentage.

3.7.2 Proportion Cited

3.7.2.1 Bibliographic form wise distribution of citations

Bibliographic form wise distribution of citations in this study refers to distribution of citations cited in the text and its bibliographic format indicated at the end of each thesis. This was studied under following categories:

3.7.2.1.1 Based on year

This was operationally defined as distribution of in-text citations in theses based on the year of publication. The in-text citations were computed from all theses under each division and categorised based on year of publication with range. The results were expressed in terms of frequency and percentage.

Sl.No.	Category	Count
1	Below 1900	
2	1900-1930	
3	1931-1960	
4	1961-1990	
5	Above 1990	

Range= 30

3.7.2.1.2 Based on source

Source of citations in this study refers to the type or source of publication citation approached by researcher in the thesis during research work. Various sources of citations were identified based on their bibliographic format indicated at the end of each thesis and recorded. All the theses under each department were categorised based on source of citations division wise. The results were expressed in terms of frequency and percentage. Under each division 'ten' most cites sources were presented in results and discussion while the detailed tables in appendix IV.

3.7.2.2 Geographic distribution of citations

Geographic distribution of citations in this study was defined as citations from which country are referred more by researchers. They were divided into national and international publications. Each publication's source published from India belonged to national publications whereas sources other than from India were placed under international publications. The citations from all the theses were classified into national and international publications. Further, these were categorised department wise with mean number of citations as check and presented under each division.

3.7.2.3 Average number of citations

It was operationalised as average number of citations per dissertation cited department wise. Under each department average number of citations were recorded and presented along with range showing minimum to maximum number of citations.

3.8 OPERATIONALIZATION OF PERSONAL AND SOCIAL CHARACTERISTICS OF STUDENTS AND TEACHERS

A total of 'six' and 'seven' profile characteristics that influence both students and teachers respectively were studied after detailed review of literature and discussion with subject matter specialists accustomed with objectives set for the study. The personal and social characteristics and their measurement chosen for the study was illustrated in table 1 for both students and teachers.

Table 1: Personal and social characteristics of students and teachers

Sl.No.	Characteristics of students	Sl.No.	Characteristics of teachers
1	Age	1	Age
2	Gender	2	Gender
3	Locality	3	Educational qualifications
4	Educational background	4	Guidance experience
5	Parental annual income	5	Number of PhD students previously guided or guiding
6	Research skill of student	6	Number of PhD students currently guiding
		7	Externally aided projects
		8	Papers published

3.8.1 Age of both students and teachers

Age in this study refers to as number of years completed by the respondent at the time of investigation. In case of students, age was categorised into above mean and below mean with mean as check. As for teachers, their age at the time of investigation is recorded and classified into three categories based on minimum, maximum and range.

3.8.2 Gender of students and teachers

Gender in this study was operationally defined as biological distinction of respondents as either male or female. The respondents were categorised as either male or female with the results calculated based on frequency and percentage.

3.8.3 Locality of students

Locality here refers to the city, town or village that respondents are native to and were calculated and expressed under each category as frequency and percentage.

Sl.No.	Locality
1	City
2	Town
3	Village

3.8.4 Educational Background of students

Educational background of students in this study was defined as education the students have undergone beginning from kindergarten and ending with Master's or Ph.D. degree. Similarly, here it was categorised into type of school/universities they attended and medium of instruction during their schooling. These results were recorded and calculated as frequency and percentage.

Based on type of school/universities attended by students:

Category	Types of schools/universities
Up to X class	Government/Aided private/Unaided private
XII class	Government/Aided private/Unaided private
Undergraduate (B.Sc.)	Government /Aided private
Post-graduate (M.Sc.)	Government/Aided

Based on medium of instruction:

Sl. No.	Medium of instruction
1	English (E)
2	Vernacular (V)

3.8.5 Parental annual income of students

Parental annual income in this study refers to income in rupees earned by student's parents annually. The parental annual income as perceived by students was categorised based on mean as check and results were explained in frequency and percentage.

Parental annual income (in lakhs)	Category
Average annual income	Above mean
	Below mean

3.8.6 Research skill of students

Research skill in this study was operationally defined as the ability to search for, locate, extract, establish, evaluate and use of present information that is relevant to a particular topic. In order to study research skill of students, six types of skills were evaluated namely, information seeking skills, methodology skills, problem solving skills, statistical/analytical skills, communication skills and universal outcomes.

Information seeking skills refers to as ability to search, use, and evaluate information. Methodology skills means identifying and designing appropriate research procedure, understanding the limitations and scope of research study. Problem solving skills refers to ability of students to identify, define and analyse problems, to create solutions and evaluate them and to choose the best solution for a particular context. Statistical or analytical skills define the ability of researchers to carry out data collection and analysing procedure besides understanding them. Communications skills of students for research refers to ability to write and present the research and its findings whereas universal outcomes refer to general skills necessary for researcher in conducting the research. Universal outcomes of research refer to general skills necessary for researcher in conducting the research.

The statements under each skill were mentioned in appendix V and were measured using five point Likert scale. The response for each statement from all respondents was rated on 5-point continuum (strongly agree, agree, undecided, disagree and strongly disagree) in terms of frequency. Total score for each statement was computed except score for ‘undecided’ as it indicates neither agree or disagree with statement as respondents were unsure about their decision. The total score was then ranked from highest to lowest. The maximum and minimum score for each statement under all the research skills was ‘two hundred and fifty’ and ‘fifty’ respectively.

The scoring for all types of research skills is presented below:

Information seeking skills		Methodology skills	
Response	**Score**	**Response**	**Score**
Strongly agree (SA)	5	Very satisfactory (VS)	5
Agree (A)	4	Satisfactory (S)	4
Undecided (UN)	3	Not very poor (NVP)	3
Disagree (DA)	2	Poor (P)	2
Strongly disagree (SDA)	1	Very poor (VP)	1
Problem solving skills		**Statistical/analytical skills**	
Response	**Score**	**Response**	**Score**
Strongly agree (SA)	5	Strongly agree (SA)	5
Agree (A)	4	Agree (A)	4
Undecided (UN)	3	Undecided (UN)	3
Disagree (DA)	2	Disagree (DA)	2
Strongly disagree (SDA)	1	Strongly disagree (SDA)	1
Communication skills		**Universal outcomes**	
Response	**Score**	**Response**	**Score**
Strongly agree (SA)	5	Strongly agree (SA)	5
Agree (A)	4	Agree (A)	4
Undecided (UN)	3	Undecided (UN)	3
Disagree (DA)	2	Disagree (DA)	2
Strongly disagree (SDA)	1	Strongly disagree (SDA)	1

3.8.7 Educational qualifications of teachers

Education in this study was operationalised as to the extent of formal education possessed by the respondent at the time of survey. The respondents were categorised based on different category and expressed in terms of frequency and percentage.

Sl.No.	Category	Universities
1	Master of Science (M.Sc.)	KAU/Other
2	Doctor of Philosophy (Ph.D.)	KAU/Other
3	Other specialization	Other

3.8.8 Guidance experience

Guidance experience in this study was operationalised as number of years of experience in guiding completed by teachers from the time of stating their guideship. The respondent’s experience was recorded in terms of years and categorised into low, medium and high based on quartiles and expressed by frequency and percentage.

Category	Criteria
Low	<Q1
Medium	Between Q1 and Q3
High	>Q3

3.8.9 Number of students previously guided or guiding

This was operationally defined as total number of PhD students the teachers have guided or guiding previously at the time of investigation. Based on the information obtained during interview of teachers (Appendix VI) they were categorised based on frequency and percentage with respect to number of students they guided or guiding previously.

3.8.10 Number of students currently guiding

It refers to the total number of PhD students the teachers were guiding at present. Based on the information obtained during interview of teachers (Appendix VI) they were categorised based on number of students they were currently guiding and calculated based on frequency and percentage.

3.8.11 Externally aided project

Externally aided projects refer to projects that were financed by state government or any other agencies in states for augmenting the states' resources that play an important role in development process. Based on number of projects undertaken as Principal Investigator (PI) by respondents their range is determined and expressed by frequency and percentage. Further average number of projects per teacher was also calculated.

3.8.12 Number of papers published

Number of papers published refer to total number of papers published by Ph.D. students under the guidance of teachers. The number of papers published under the guidance of teachers were counted and expressed in terms of frequency and percentage of teacher respondents.

3.9 OPERATIONALIZATION AND MEASUREMENT OF OTHER IMPORTANT VARIABLES AS PERCEIVED BY BOTH STUDENTS AND TEACHERS

3.9.1 Outcomes of research

Along with personal and social characteristics of students and teachers some other important variables were purposively studied that may influence researcher's study. The operationalisation and measurement of those variables as perceived by both students and teachers is presented below:

3..9.1.1 Resource availability

Resource availability refers to the availability of literature, research materials, raw materials and funds for the purpose of conducting research. Under each category a score of 'one' was given to 'yes' and 'zero' to response 'no' respectively in terms of each category of resource availability. The extent of availability for 'yes' response was computed using a three-point continuum *viz.* very much available, available, less available with scores 3,2 and 1 respectively. The minimum to maximum score that could be attained from students' responses was 'fifty to one hundred and fifty' whereas from teachers it was ‘thirty to ninety’. The results in case of extent of resource availability was expressed by frequency and percentage.

3.9.1.2 Resource attainment difficulty

It refers to the difficulty in attaining the literature, research materials, raw materials and funds for conducting research. In terms of attainment difficulty of each resource, ‘yes’ response was given score ‘one’ and ‘no’ response given score ‘zero’. The extent of attainment difficulty for ‘yes’ response was calculated further using a 3-point continuum namely, very difficult, difficult and less difficult with score 3,2 and 1 respectively. The minimum and maximum score that can be attained from response of students was ‘fifty’ and ‘one hundred and fifty’ whereas ‘thirty’ and ‘ninety’ in case of teachers respectively. These results were presented in frequency and percentage under extent of resource attainment difficulty.

3.9.1.3 Acquaintance support as perceived by students

Acquaintance support in this study was operationally defined as extent of help the students were receiving from his/her friends or peers, major advisor, advisory committee members, non-advisory members, own department and other department. Scores for ‘yes’ or ‘no’ responses were given as ‘one’ and ‘zero’ respectively. In order to measure their extent of support for ‘yes’ response a 3-point continuum was selected namely, very much, much and not very much with scores as 3,2, and 1 respectively. The minimum and maximum score that could be attained from respondents was ‘fifty’ and ‘one hundred and fifty’ respectively which was expressed in frequency and percentage.

3.9.1.4 Publishing difficulty as perceived by students

Publishing difficulty in this study refers to the difficulty faced by the students while giving the papers for publishing in journals. Scoring procedure followed was an ‘yes’ or ‘no’ response with ‘one’ and ‘zero’ as score respectively and to their extent of difficulty in case of ‘yes’ responses was measured in a three-point continuum namely, very difficult, difficult and less difficult with scoring as 3,2 and 1 respectively. The minimum and maximum score that can be obtained from respondents based on their difficulty to publish was ‘fifty’ and ‘one hundred and fifty’ respectively. These results were expressed in terms of frequency and percentage.

3.9.1.5 Research work environment as perceived by students

Research work environment refers to the surrounding conditions in which the researchers work. This includes technical, human and organizational environment. For the question on whether research work environment is workable or not a score or ‘one’ and ‘zero’ was given to ‘yes’ and ‘no’ response respectively. If the response was yes, the extent of workability was calculated using 3-point continuum namely, very much, much and not much with scores 3,2 and 1 respectively. The minimum and maximum score would be ‘fifty’ and ‘one hundred fifty’ respectively and was expressed in terms of frequency and percentage.

3.9.1.6 Researcher satisfaction

Researcher’s satisfaction refers to short term attitude resulting from an evaluation of students’ educational experience, services and facilities. For measuring the researcher’s satisfaction on whether they were satisfied or not with their research work a score of ‘one’ and ‘zero’ was given for ‘yes’ or ‘no’ response respectively. The scoring for the extent of satisfaction with a response ‘yes’ was indicated as three, two and one for very much, much and not much respectively. The maximum and minimum score that could be attained by students was ‘one hundred fifty’ and ‘fifty’ respectively which was calculated as frequency and percentage.

3.9.2 Gaps in PhD research themes

Gap in this study was operationally defined as breach between the research themes framed by university and the students and teachers perception about their adequacy regarding those research themes irrespective of the department they belonged. Regarding this a questionnaire was administered to teachers and students in different departments asking them to rate about the research themes framed with respect to their own departments from 1 to 10 in order to find the gaps as perceived by both teachers and students. The responses average weightage was recorded and expressed in terms of percentage.

3.9.3 Ability of students to do research

Ability of students in this study refers to skills they attain for conducting research as perceived by teachers. The different statements indicating general research skills required for students were given for teachers in their questionnaire (appendix VI) for evaluation with 5-point continuum. The scoring procedure used for this was Likert scale *viz.* strongly agree, agree, undecided, disagree and strongly disagree was five, four, three, two and one respectively. Overall score range from each teacher response was categorised as low, medium and high with mean score and standard deviation as check. The results were conveyed with frequency and percentage. The maximum and minimum score obtained from teachers would be 'one hundred and fifty' and 'thirty' respectively.

Response	**Score**
Strongly agree (SA)	5
Agree (A)	4
Undecided (UN)	3
Disagree (DA)	2
Strongly disagree (SDA)	1

3.10 OPPERATIONALISATION AND MEASUREMNT OF ATTITUDE OF STUDENTS TOWARDS RESEARCH

Attitude in this study refers to the positive or negative mental predisposition of the students towards research. Student's attitude towards doctoral research and teacher's perception about their attitude was measured. Attitude of students towards research was measured using 5-point continuum Likert scale.

A set of 'twenty' and 'ten' statements were given for both students (appendix V) and teachers (appendix VI) respectively for rating them based on above scale. The total score was computed by adding the scores for each respondent from all statements. The maximum and minimum score that could be obtained was 'two hundred and fifty' and 'fifty' for students and 'one hundred fifty' and 'thirty' respectively. The computed overall range of scores were categorised into low, medium, high indicating poor, good and very good attitude respectively based on mean score and standard deviation as check. The results were expressed with frequency and percentage. Scoring procedure is presented as following:

Response	**Score**
Strongly agree (SA)	5
Agree (A)	4
Undecided (UN)	3
Disagree (DA)	2
Strongly disagree (SDA)	1

3.11 CONSTRAINTS AS PERCEIVED BY STUDENTS AND TEACHERS DURING THE CONDUCT OF PhD RESEARCH

A set of open ended questions were given to both students and teachers to find out constraints in conducting doctoral research. The constraints as perceived by both students and teachers were listed respectively. Based on commonality of responses constraints were recorded and categorised. Their average weightage and percentage were calculated. Later, based on total percentage rankings were given.

3.12 SUGGESTIONS FOR IMPROVEMENT

Suggestions for improving doctoral research as perceived by teachers were explained. The same were documented after discussing with experts for attaining major strategies to suggest for improvement in PhD research.

3.13 DATA COLLECTION PROCEDURE

Based on review of literature a checklist was prepared to conduct a desk study on content pattern and academic research productivity of thesis (appendix VII). A well-structured pretested interview schedule was prepared and used for data collection from both student and teacher respondents. A preliminary study was conducted to a non-sample population with this pretested questionnaire and suitable modifications were done and finalized after careful discussion with subject matter specialists. A separate interview schedule was given to students (appendix V) and teachers (appendix VI) and then directly administered to the respondents randomly. There were multiple choice questions, open ended questions and questions with rating scale.

3.14 STATISTICAL TOOLS USED IN THE STUDY

The data collected were scored, tabulated and analysed using statistical methods as described below:

3.14.1 Range

Range is the difference between the largest and smallest values for set of data. Range is used to find out the parameters like sample size, reference based on years, citations distribution based on year, geographic wise distribution of citations and average number of citations per dissertation in this study.

3.14.2 Mean

Mean is the numerical average of set of values. The different attributes in this study for theses and respondents were grouped into categories with mean as check. After grouping their frequencies and percentages were worked out.

3.14.3 Frequency

Frequency is the number of times a data value occurs in a particular cell. It is denoted by letter 'f'.

3.14.4 Percentage analysis

After grouping the theses based on selected parameters and respondents into various categories, a simple percentage was worked out to find out the distribution based on percentage for both theses and respondents. Percentage analysis was also used for interpretation of the results of some variables.

3.14.5 Quartiles

Quartiles are used to divide data set into three quarters. This was used to find results for variables such as number of objectives, mean number of references and guidance experience of teachers. It was also used for dividing the theses into categories namely, low, medium and high with respect to different parameters.

3.14.6 Standard deviation

Standard deviation is measure of dispersion of data. It was used to provide an idea about variability of some parameters.

3.14.7 Correlation analysis

Correlation analysis was done to explain the relationship between the overall attitude of students towards research and selected independent variables of students and teachers respectively that influence doctoral research. Correlation coefficient is used to estimate the quality of the relationship between two variables. The significance of the correlation coefficient was tested at 5 per cent, 1 per cent and 10 per cent levels of significance.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][\sum y^2 - (\sum y)^2]}}$$

3.15 HYPOTHESIS OF THE STUDY

In the view of deliberations made in this chapter on review of literature and prospective arguments that could arise out of the study, the following hypotheses were set up and investigation was made to test theses hypotheses.

H1: The content pattern attributes are not appropriate enough to explain the qualitative features of theses submitted by all departments

H2: The academic research productivity parameters are not appropriate enough to explain the qualitative features of theses submitted by all departments

H3: There exists no difference between attitude of students towards research and selected independent variables as perceived by students

H4: There exists no difference between attitude of students towards research and selected independent variables as perceived by teachers

H5: There exists no gap for the future thrust area for PhD research as perceived by KAU teachers in relation to ex-post facto themes covered for last 10 years.

H6: The thrust areas framed by the university for PhD research is fully touched or focused on.

Results and Discussion

RESULTS AND DISCUSSIONS

The main chapter of the study is "Results and discussions" which provides necessary information by drawing valid inferences and suggestions for the findings in the study. Results show the key findings of the study supported with tables or figures or graphs which is followed by discussion that elucidates and analyse the findings of the study which gives a proper perspective on research that is being investigated. For the purpose of precision and conciseness, with reference to objectives results and discussion were interpreted, analysed and conclusions drawn were presented under following headings:

4.1 Trends in PhD research

4.2 Content patterns of doctoral research studies in terms of different parameters

4.3 Academic research productivity of doctoral dissertations in terms of different attributes

4.4 Personal and social characteristics of students and teachers

4.5 Other important variables of the study

4.6 Attitude of students towards research

4.7 Constraints as perceived by students and teachers during the conduct of PhD research

4.8 Suggestions for improvement

4.9 Hypothesis set up for the study

4.1 TRENDS IN PHD RESEARCH

Trends in PhD research in this study was operationalised as pattern of general tendency of data to move in certain direction overtime. The results on trends of PhD research for period of five years from 2015 to 2019 under following sub-heads:

4.1.1. Number of theses published per year

4.1.2 Year wise categorization of theses under each division

4.1.1 Number of theses Published per Year

The number of theses published in this study refers to a unit that forms a part of the system of counting year wise. The results for number of PhD theses published at College of Agriculture, Vellayani from 2015 to 2019 is shown in table 2.

Table 2: Distribution of PhD theses published from 2015-2019

N=74

Sl. No.	Year	f	%
1	2015	13	17.57
2	2016	08	10.81
3	2017	24	32.43
4	2018	18	24.32
5	2019	11	14.87
	Total	74	100.00

On basis of above data, it was observed that a total of 74 theses were submitted during period of 2015 to 2019. Among these highest number of theses were submitted during 2017 with 32.43 per cent, followed by 24.32 per cent in 2018, 17.57 per cent in 2015, 14.87 per cent in 2019 and with least number of submissions in 2016 with 10.81 per cen. It was observed that there was an increasing trend of submissions from 2016 to 2017 which started to decrease in following years. This inconsistency as observed in fig.6 in theses submissions may be due to students' discontinuing research or dropping out from university after getting job or readmitting to continue research later on, delay in thesis submissions or because of marriage.

4.1.2. Year Wise Categorization of theses under Each Division

Under each division theses were categorised year wise based on each department and results were presented under table 3, 4, 5,6, and 7.

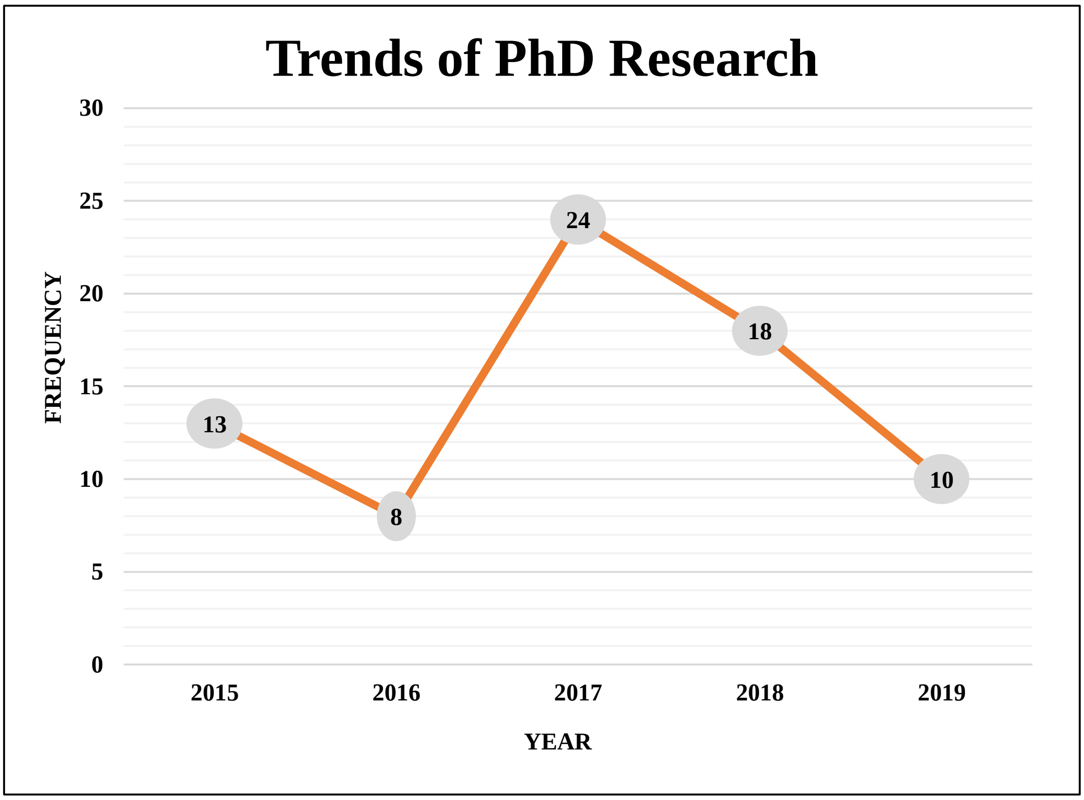


Fig. 6 Trends of PhD theses published from 2015-2019

Table 3: Categorisation of theses under crop production division

Sl.No.	Year	Agronomy n=14		SSAC n=8		Horticulture n=11		Overall N=33	
		f	%	f	%	f	%	f	%
1	2015	0	00.00	2	25.00	2	18.18	4	12.12
2	2016	5	35.71	0	00.00	1	9.10	6	18.18
3	2017	4	28.57	5	62.50	3	27.27	12	36.37
4	2018	3	21.43	0	0.00	2	18.18	5	15.15
5	2019	2	14.29	1	12.50	3	27.27	6	18.18
Total		14	100.00	8	100.00	11	100.00	33	100.00

It can be seen from table 3 that a total of 33 theses were submitted under crop production division. Out of which 14 theses belonged from Agronomy, 8 from Soil science and Agricultural Chemistry and 11 from Horticulture during 2015-2019. Overall, 36.37 per cent theses were submitted during 2017 followed by 18.18 percent during 2016 and 2019 respectively, 15.15 per cent during 2018 and with lowest percentage (12.12%) during 2015.

In Department of Agronomy highest (five) number of theses were submitted during 2016 followed by four in 2017, three in 2018, two in 2019 and with no publications during 2015. In case of Department of Soil Science and Agricultural Chemistry, majority (five) of theses were submitted during 2017, followed by two in 2015, one in 2019 and no publications during 2016 and 2018 respectively. From Department of Horticulture, highest number of theses (three) were submitted during 2017 and 2019 respectively followed by two during 2015 and 2018 respectively and only one publication during 2016.

Overall analysis, department wise indicated that over different years there was decrease in the percentage of theses submitted for the period from 2016 to 2019 in case of Agronomy and a fluctuating trend among Soil Science and Agricultural Chemistry and Horticulture department theses.

Hence, it can be inferred from analysis that there was an increasing trend among theses submitted from 2015-2017 and fluctuating trend during 2017-2019 under crop production division.

Table 4: Categorisation of theses under crop protection division

Sl.No.	Year	Entomology n=6		Plant pathology n=6		Overall N=12	
		f	%	f	%	f	%
1	2015	0	00.00	1	16.67	1	8.33
2	2016	2	33.33	0	00.00	2	16.67
3	2017	2	33.33	2	33.33	4	33.33
4	2018	2	33.34	3	50.00	5	41.67
5	2019	0	00.00	0	00.00	0	00.00
	Total	6	100.00	6	100.00	12	100.00

On perusal of data from table 4 indicates that a total of 12 theses were submitted under crop protection division. Out of which six theses each belonged from department of Agricultural Entomology and Plant Pathology. Overall, 41.67 per cent theses were submitted during 2018 followed by 33.33 per cent during 2017, 16.67 per cent during 2016, 8.33 per cent during 2015 and no submissions during 2019.

Department wise analysis of results indicated that from Department of Agricultural Entomology, equal number of theses (two) were submitted during 2016, 2017, 2018 and no publications during 2015 and 2019. From department of Plant Pathology, majority of theses (three) were submitted during 2018, followed by two in 2017, one in 2015 and no submissions during 2016 and 2019.

An overall analysis of the study over different years elucidated that there was an increase in the percentage of theses submitted for the periods from 2015 to 2019 in case of crop protection theses.

Table 5: Categorisation of theses under crop improvement division

Sl. No.	Year	Plant physiology n=5		PBG n=13		PBT n=2		Overall N=20	
		f	%	f	%	f	%	f	%
1	2015	2	40.00	1	7.69	0	00.00	3	15.00
2	2016	0	00.00	0	00.00	1	50.00	1	5.00
3	2017	1	20.00	7	53.85	0	0.00	8	40.00
4	2018	0	0.00	4	30.77	0	0.00	4	20.00
5	2019	2	40.00	1	7.69	1	50.00	4	20.00
	Total	5	100.00	13	100.00	2	100	20	100

From table 5, it can be observed that a total of 20 theses were submitted under crop protection division during 2015-2019. Out of which five theses were from Plant Physiology, thirteen from Department of Plant Breeding and Genetics and two from Department of Plant Biotechnology. Overall, 40.00 per cent theses were submitted during 2017 followed by 20.00 percent during 2018 and 2019 respectively, 15.00 per cent during 2015 and with lowest percentage (5.00%) during 2016.

Over the years, in Department of Plant Physiology, highest percentage (40.00%) of theses were submitted during 2015 and 2019 respectively followed by 20.00 per cent during 2017 and no submissions during 2016 and 2018. From Department of Plant Pathology, majority of theses (53.85%) were submitted during 2017, followed by 30.77 per cent in 2018, 7.69 per cent during both 2015 and 2019 and no submissions during 2016.

An overall interpreted analysis of the study represents that there was an increase in the percentage of theses submitted for the periods from 2015 to 2017 and decrease in percentage during 2017 to 2018 and it remained same from period 2018 to 2019 in case of crop improvement theses.

Table 6: Categorisation of theses under social science division

Sl. No.	Year	Agricultural economics n=1		Agricultural extension n=4		Overall N=5	
		f	%	f	%	f	%
1	2015	1	100	0	00.00	1	20.00
2	2016	0	00.00	2	50.00	2	40.00
3	2017	0	00.00	0	00.00	0	00.00
4	2018	0	00.00	2	50.00	2	40.00
5	2019	0	00.00	0	00.00	0	00.00
	Total	1	100.00	4	100.00	5	100.00

Table 6 shows that a total of five theses were submitted under social science division. Out of which only one thesis was submitted under Department of Agricultural Economics during 2015 and remaining four theses were submitted under Department of Agricultural Extension with two each during 2016 and 2018 accounting 20.00 per cent, 40.00 per cent and 40.00 per cent respectively in total. Hence from this cursory study, it can be concluded that there were no submissions from 2016-2019 under Agricultural Economics department and a growing trend was observed under department of Agricultural Extension during period from 2015-2016 followed by no submissions in 2017 that increased in following year which again fallen to no submissions during 2019.

Table 7: Categorisation of theses under community science division

Sl.No.	Year	Community science N=4	
		f	%
1	2015	2	50.00
2	2016	0	00.00
3	2017	0	00.00
4	2018	1	25.00
5	2019	1	25.00
	Total	4	100

A comprehensive analysis of the table 7 showed that from the overall theses submitted under Community Science department, 50.00 per cent were submitted during 2015 and remaining two during 2018 and 2019 each one respectively accounting 25.00 per cent.

Hence, it can be concluded that there were no theses submitted during 2016 and 2017 indicating a complete drop from 2015 to 2016 that continued same till 2017 which showed slight increase in trend during 2018-2019.

4.2 CONTENT PATTERNS OF DOCTORAL RESEARCH STUDIES IN TERMS OF DIFFERENT PARAMETERS

A total of 'nine' attributes (4.2.1 to 4.2.9) were selected in general of study of content pattern of the research studies in all departments under different divisions whereas 'one' more attribute (4.2.10) was selected for theses belonging to social science division. The results were elucidated based on the parameters that listed below.

4.2.1 Crops or Areas focused

It refers to the different types of crops taken up for the study or the different areas of study other than crops that have been focused upon by the researchers. The results showing distribution of theses based on crops or areas focused are illustrated in table 8.

A comprehensive overall analysis of results in table 8 and fig.8 reflected that 20.27 per cent of researches focused on cereals especially rice followed by vegetables (14.87%), fruits (13.51%), tuber crops (8.11%), others (6.76%), 5.41 per cent on flowers and fodder crops, 4.05 per cent on mushrooms and plantation crops, 2.70 per cent in legumes and wetland ecosystem respectively, 1.35 per cent each in spices, organic farming, insecticide resistance, fungi, Information and Communication Technology (ICT), climate change, sustainable agriculture, diffusion and adoption and value addition.

Division wise results reflected that more than 20 per cent of studies were focused on cereals (especially rice) followed by 18.18 per cent on fruits, 12.12 per cent on others, 9.09 per cent each in tuber crops and vegetables, 6.06 per cent each on flowers, fodder crops and plantation crops, 3.03 per cent each on wetland ecosystem and organic farming among crop production. Likewise, 25.00 per cent of theses each studied on mushrooms and vegetables followed by 16.67 per cent on fruits, 8.33 per cent each on legumes, tuber crops, insecticide resistance and fungi under crop protection division. Around 30.00 per cent of researches under crop improvement division were studied on cereals (especially rice) followed by 20.00 per cent on vegetables, 10.00 per cent each on flowers, fodder crops and tuber crops, 5.00 per cent each on fruits, legumes, planation crops and spice crops. Regarding theses under social science division, 20.00 per cent each of researches focused on different areas *viz*. wetland ecosystem, ICT, climate change, sustainable agriculture and diffusion and adoption. Also, 25.00 per cent each of studies under Community Science were focused on fruits, vegetables, value addition and others.

Above results it can be summarised that regardless of divisions most of the studies were on cereals, vegetables, fruits, tuber crops. Crop protection division took up researches on mushrooms, fungi and insecticide resistance. Crops that were studied under cereals, flowers, fodder crops, fruits, legumes, plantation crops, spices, vegetables, tuber crops were listed as following:

Cereals	: Rice (wetland rice and upland rice)
Flowers	: Anthurium, Marigold, Rose and Wild orchid
Fodder crops	: Palisade grass, Tannia, Vetiver, Guinea grass and Fodder cowpea
Fruits	: Banana, Mango, Watermelon, Pineapple and Jackfruit
Legumes	: Cowpea and Yard long bean
Plantation crops	: Coconut and Cashew Apple
Spices	: Black pepper
Vegetables	: Tomato, Chilli, Culinary Melon, Bitter Gourd, Cabbage, Cauliflower, Amaranthus, Okra and Brinjal
Tuber crops	: Milk yam and Cassava

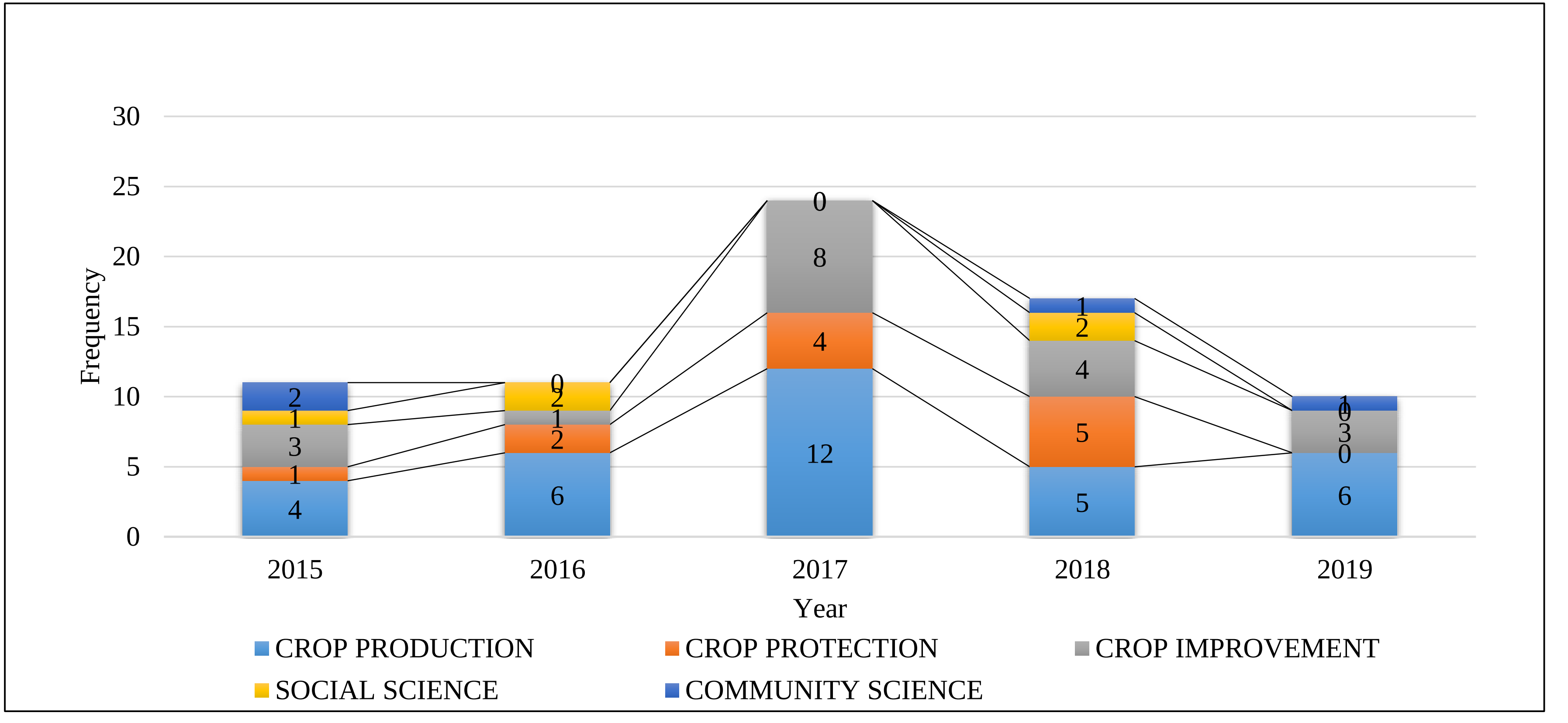


Fig.7: Trends of PhD theses published from 2015-2019 based on all the divisions (N=74)

Table 8: Distribution of Ph.D. theses based on crops/areas focused

Sl.No.	Crop / Area focused	Crop production n=33		Crop protection n=12		Crop improvement n=20		Social science n=5		Community science n=4		Total N=74	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Cereals (Rice)	9	27.28	0	00.00	6	30.00	0	0.00	0	00.00	15	20.27
2	Flowers	2	6.06	0	00.00	2	10.00	0	0.00	0	00.00	4	5.41
3	Fodder crops	2	6.06	0	00.00	2	10.00	0	0.00	0	00.00	4	5.41
4	Fruits	6	18.18	2	16.67	1	5.00	0	0.00	1	25.00	10	13.51
5	Legumes	0	00.00	1	8.33	1	5.00	0	0.00	0	00.00	2	2.70
6	Mushroom	0	00.00	3	25.00	0	00.00	0	0.00	0	00.00	3	4.05
7	Plantation crops	2	6.06	0	00.00	1	5.00	0	0.00	0	00.00	3	4.05
8	Spices	0	00.00	0	00.00	1	5.00	0	0.00	0	00.00	1	1.35
9	Tuber crops	3	9.09	1	8.33	2	10.00	0	0.00	0	00.00	6	8.11

10	Vegetables	3	9.09	3	25.00	4	20.00	0	0.00	1	25.00	11	14.87
11	Wetland ecosystem	1	3.03	0	00.00	0	00.00	1	20.00	0	00.00	2	2.70
12	Organic farming	1	3.03	0	00.00	0	00.00	0	0.00	0	00.00	1	1.35
13	Insecticide resistance	0	00.00	1	8.33	0	00.00	0	0.00	0	00.00	1	1.35
14	Fungi	0	00.00	1	8.34	0	00.00	0	0.00	0	00.00	1	1.35
15	ICT	0	00.00	0	00.00	0	00.00	1	20.00	0	00.00	1	1.35
16	Climate change	0	00.00	0	00.00	0	00.00	1	20.00	0	00.00	1	1.35
17	Sustainable agriculture	0	00.00	0	00.00	0	00.00	1	20.00	0	00.00	1	1.35
18	Diffusion & adoption	0	00.00	0	00.00	0	00.00	1	20.00	0	00.00	1	1.35
19	Value addition	0	00.00	0	00.00	0	00.00	0	00.00	1	25.00	1	1.35
20	Others	4	12.12	0	00.00	0	00.00	0	00.00	1	25.00	5	6.76
	Total	33	100.00	12	100.00	20	100.00	5	100.00	4	100.00	74	100.00

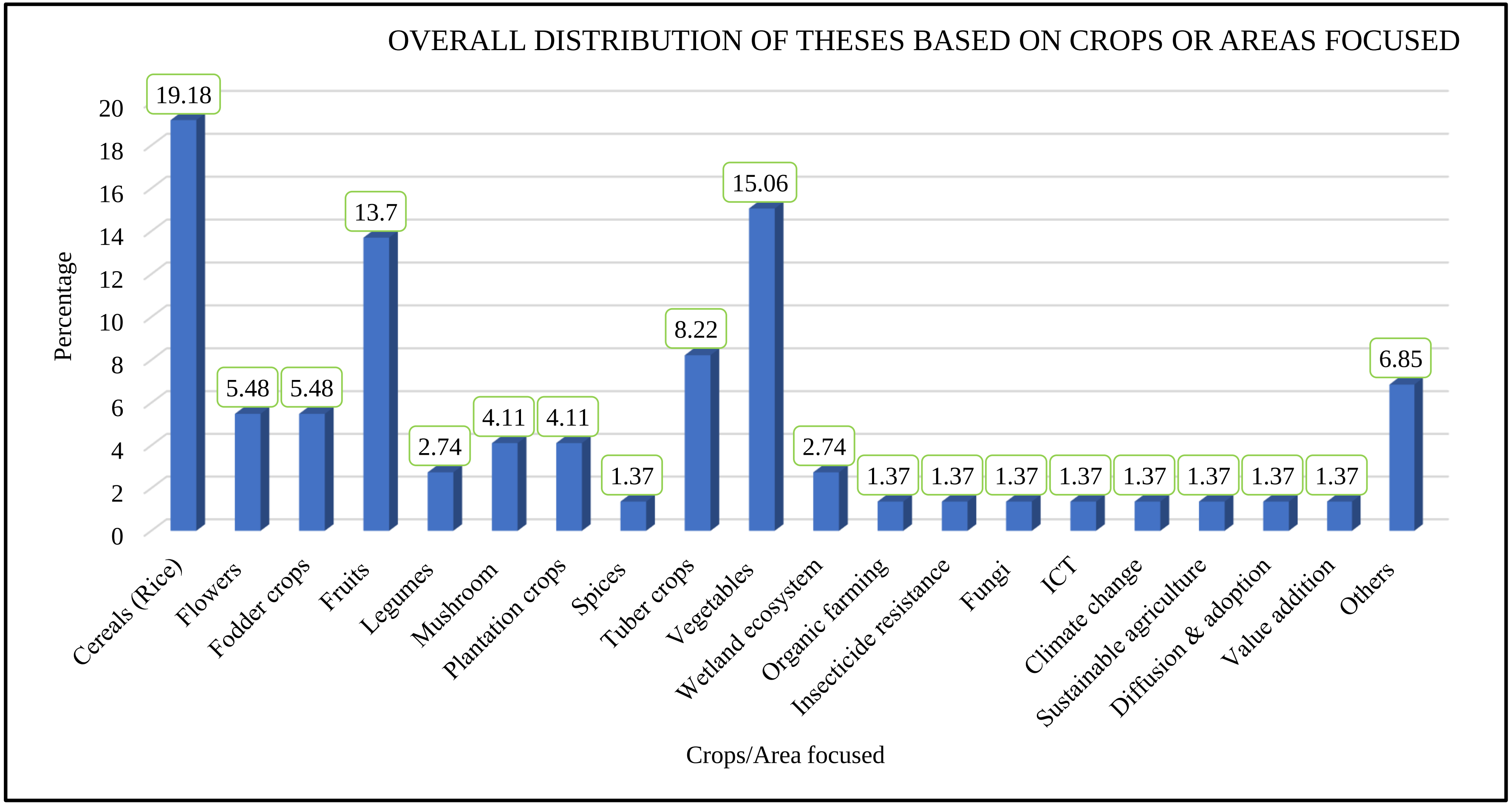


Fig.8: Overall distribution of theses based on crops or areas focused

In terms of areas focused, studies were based upon shiitake mushroom, oyster mushroom, jelly mushroom, entamopathogenic fungi and organic farming. Regarding theses under social science, areas that focused on were climate change adaptation, technology dissemination, ICT, sustainable agriculture. Areas that were dealt under community science were value addition, nutrition and lifestyle and alike that researchers also find a way to conduct study on various components and crops.

4.2.2 Thrust areas of research

Thrust areas of research in this study was operationalised as different areas of study other than crops that have been focused upon by the researchers. It can be elucidated under following sub-headings:

4.2.1. Categorisation of touched and untouched thrust areas under each PC groups

4.2.2. Thrust areas of PhD research under each PC group

4.2.1. Categorisation of Touched and Untouched Thrust Areas under each PC Groups

Project Coordination (PC) groups are an institutional mechanisms framed by the university for research purpose, evaluation and easy management of the same for project coordinators. The result of touched and untouched thrust areas under each PC groups for two periods from 2011-2014 and 2015-2017 were illustrated in table 9 and 10.

Overall analysis of table 9 and fig. 9 shows that among a total of 22 PC groups from period of 2011 to 2014, 19 PC groups have 80.00 or more per cent of untouched thrust areas. Among them Spices and Plantation Crops (SPC), Pulses and Oil Seeds (POS), Forage and Green Manure crops (FGM), Gender Studies (GS) and Agro-Economic Studies (AES) were not touched for conducting doctoral research. Remaining untouched thrust areas were 92.31 per cent from Post-Harvest Technology and Value Addition (PHT) followed by 90.91 per cent from Coconut and Other Palms (COP), 85.00 per cent from Vegetables (VEG), 84.62 per cent from Beneficial Organisms (BO) along with Organic Farming (OF), 83.33 per cent from Fruits (FR), Plant Protection (PP) and Food Science and Nutrition (FSN), 82.35 per cent from

Agricultural Extension and Development Studies (AEDS), 81.82 per cent from Sugar and Tuber Crops (STC) and Natural Resource Management (NRM), 81.25 per cent from Soils and Agronomy (SA), 80.00 per cent from Rice and Rice based Cropping System (RBC) and Biotechnology (BT), 77.78 per cent from Aromatic and Medicinal Plants (AMP), 71.43 per cent from Floriculture (FL) and 66.57 per cent from Crop Physiology and Biochemistry (CPB).

Table 9: Categorisation of touched and untouched thrust areas under each PC group from period 2011-2014

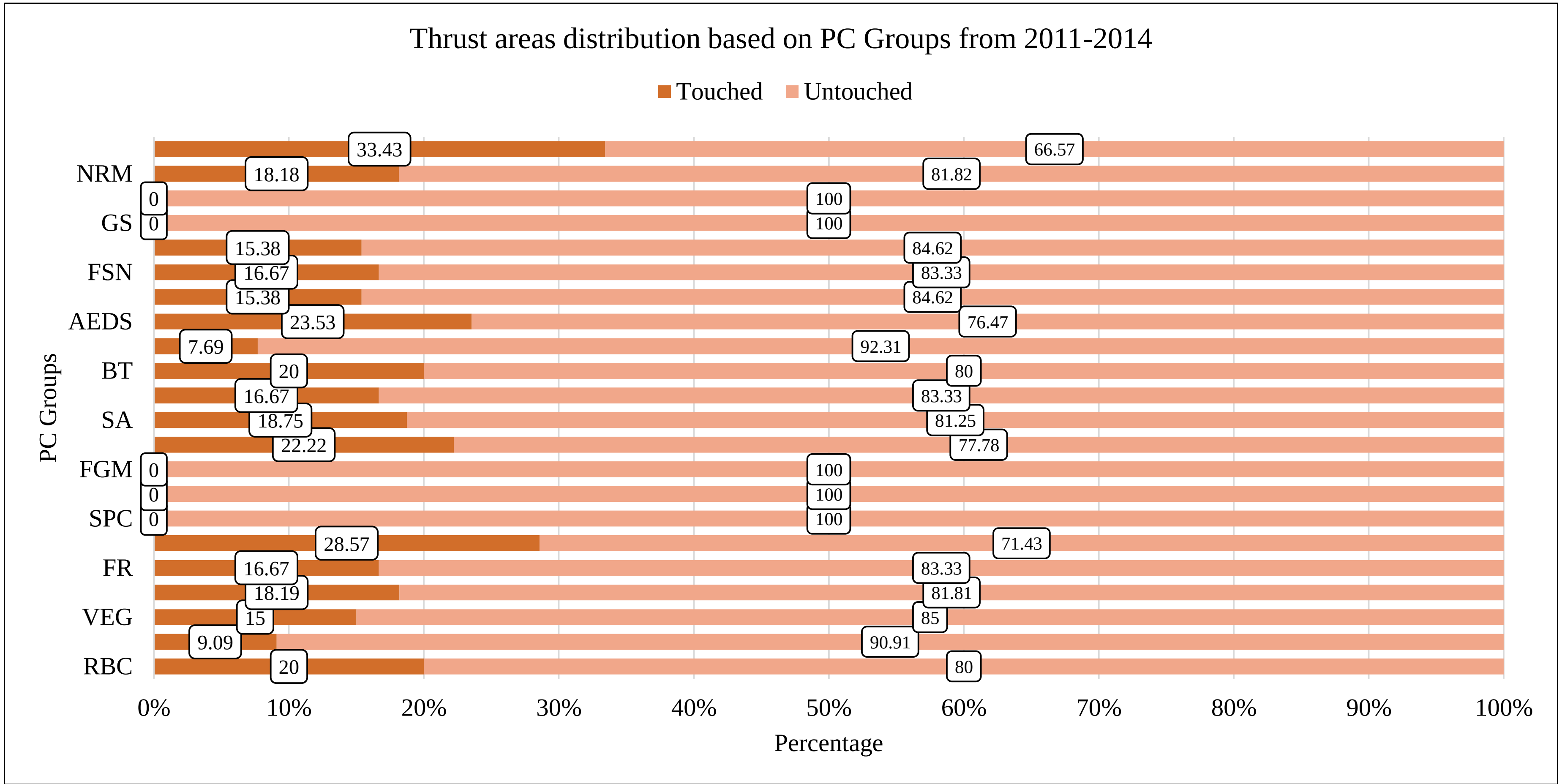
Sl. No.	PC Group	No. of thrust areas		Total	Untouched %
		Touched	Untouched		
1	Rice and rice based cropping system (RBC)	3	12	15	80.00
2	Coconut and other palms (COP)	1	10	11	90.91
3	Vegetables (VEG)	3	17	20	85.00
4	Sugar and tuber crops (STC)	2	9	11	81.81
5	Fruits (FR)	2	10	12	83.33
6	Floriculture (FL)	4	10	14	71.43
7	Spices and plantation crops (SPC)	0	10	10	100.00
8	Pulses and oil seeds (POS)	0	11	11	100.00
9	Forage and green manure crops (FGM)	0	5	5	100.00
10	Aromatic and medicinal crops (AMP)	2	7	9	77.78
11	Soils and agronomy (SA)	3	13	16	81.25

12	Plant protection (PP)	2	10	12	83.33
13	Biotechnology (BT)	2	8	10	80.00
14	Post-Harvest technology and Value addition (PHT)	1	12	13	92.31
15	Agricultural extension studies and development studies (AEDS)	3	14	17	82.35
16	Beneficial organisms (BO)	2	11	13	84.62
17	Food science and nutrition (FSN)	2	10	12	83.33
18	Organic farming (OF)	2	11	13	84.62
19	Gender studies (GS)	0	12	12	100.00
20	Agro-economic studies (AES)	0	10	10	100.00
21	Natural resource management (NRM)	2	9	11	81.82
22	Crop physiology and biochemistry (CPB)	1	2	3	66.57

On perusal of data from table 10 and fig.10 it can be observed that among 17 PC groups during 2015-2017, 14 PC groups were found to have 80.00 per cent or above number of unfocused thrust areas. The PC groups *viz.* Spices and Plantation Crops (SPC), Floriculture (FL), Post Harvest Technology (PHT) and Sugar and Tuber Crops (STC) were not focused upon for research. Remaining PC groups untouched thrust areas include 96.00 per cent from Field Crops (FC), 91.66 per cent under Agricultural Extension and Developmental Studies (AEDS) group, 90.91 per cent from Farming System Research and Climate Studies (FSRCS), Crop Pests and Beneficial Insects (CPBI) and Agricultural Economics, Statistics and Management (AESBM), 90.00 per cent from Plant Pathogens and Beneficial Microbes (PPBM), 85.71 per cent from Fruits (FR), Aromatic and Medicinal Plants (AMP) and Food Science and Nutrition (FSN) respectively, 83.33 per cent from Biotechnology, Biochemistry and Plant Physiology (BBBP),77.78 per cent of untouched area from Vegetables (VEG), 75.00 per cent from Soil Health and Organic Farming (SHOF), 70.00 per cent of untouched areas were from Rice (R) during period of 2015-2017.

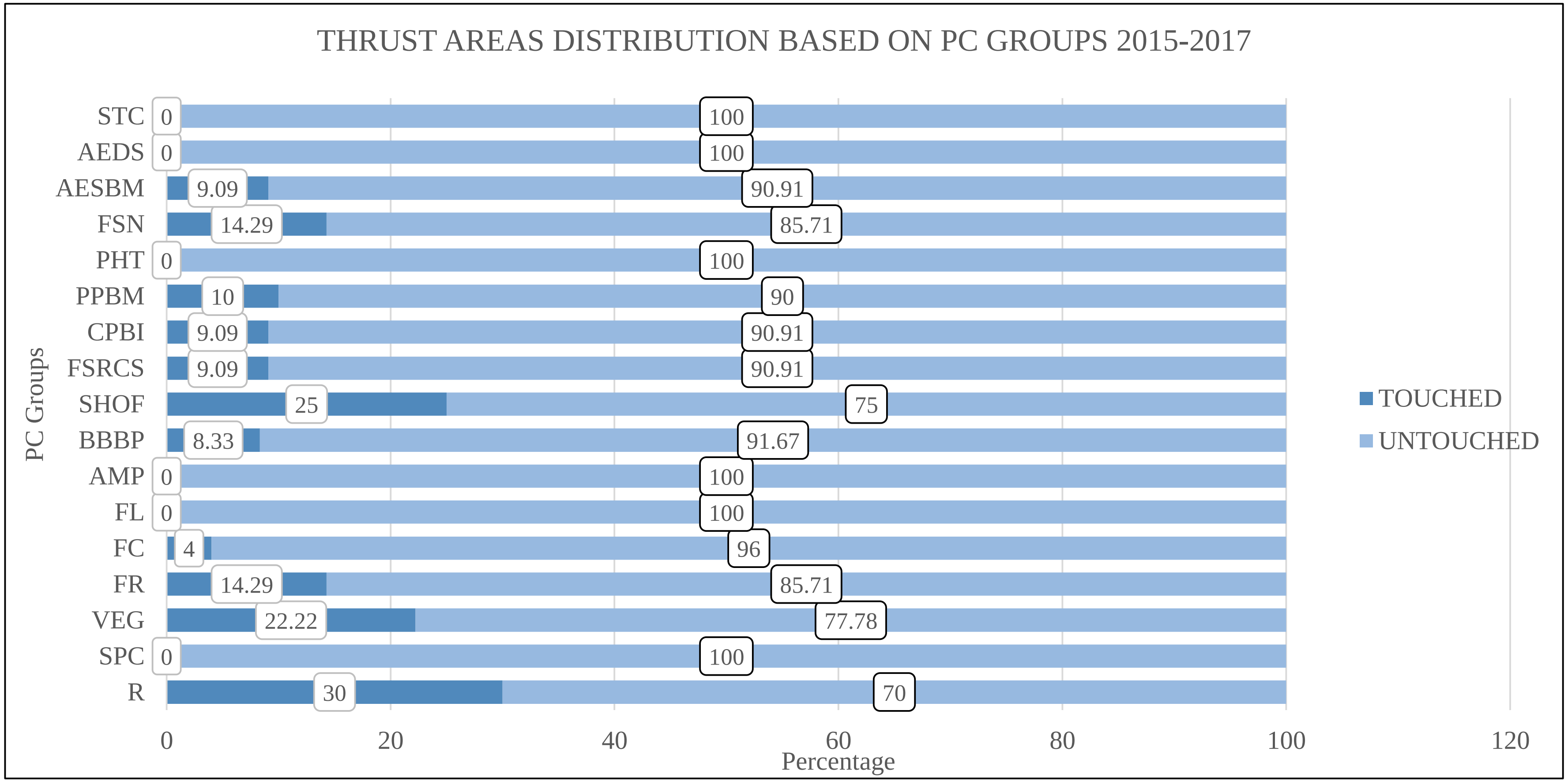
Table 10: Categorisation of touched or untouched thrust areas under each PC group from 2015-2017

Sl.No.	PC Group	No. of thrust areas		Total	Untouched %
		Touched	Untouched		
1	Rice (R)	3	7	10	70.00
2	Spices and plantation crops (SPC)	0	10	10	100.00
3	Vegetables (VEG)	2	7	9	77.78
4	Fruits (FR)	2	12	14	85.71
5	Field crops (FC)	1	24	25	96.00
6	Floriculture (FL)	0	6	6	100.00
7	Aromatic and medicinal plants (AMP)	1	6	7	85.71
8	Biotechnology, Biochemistry& Plant physiology (BBBP)	2	10	12	83.33
9	Soil health and Organic farming (SHOF)	3	9	12	75.00
10	Farming system research and climate studies (FSRCS)	1	10	11	90.91
11	Crop pests and Beneficial insects (CPBI)	1	10	11	90.91



*Rice and rice based cropping system (RBC), Coconut and other palms (COP), Vegetables (VEG), Sugar and tuber crops (STC), Fruits (FR), Floriculture (FL), Spices and plantation crops (SPC), Pulses and oilseeds (POS), Forage and green manure crops (FGM), Aromatic and medicinal plants (AMP), Soils and agronomy (SA), Plant protection (PP), Biotechnology (BT), Post-harvest technology (PHT), Agricultural extension and development studies (AEDS), Beneficial organisms (BO), Food science and nutrition (FSN), Organic farming (OF), Gender studies (GS), Agro-economic studies (AES), Natural resource management (NRM), Crop physiology and biochemistry (CPB)

Fig.9: Percentage distribution of touched and untouched thrust areas under each PC group from 2011-2014



*Rice (R), Spices and plantation crops (SPC), Vegetables (VEG), Fruits (FR), Floriculture (FL), Aromatic and medicinal plants (AMP), Biotechnology, biochemistry and plant physiology (BBPP), Soil health and organic farming (SHOF), Farming system research and climate studies (FSRCS), Crop pest and beneficial insects (CPBI), Plant pathogens and beneficial microbes (PPBM), Post-harvest technology and value addition (PHTAV), Food science and nutrition (FSN), Agricultural economics, agricultural statistics and agribusiness management (AESBM), Agricultural extension and development studies (AEDS), Sugarcane and tuber crops (STC)

Fig. 10: Percentage distribution of touched and untouched thrust areas under each PC group from 2015-2017

12	Plant pathogens and Beneficial microbes	1	9	10	90.00
13	Post-harvest technology (PHT)	0	11	11	100.00
14	Food science and nutrition (FSN)	2	12	14	85.71
15	Agricultural economics, Agricultural statistics and Agribusiness management (AESBM)	1	10	11	90.91
16	Agricultural extension and Development studies (AEDS)	0	12	12	100.00
17	Sugar and Tuber crops (STC)	0	10	10	100.00

For better understanding it was important to know maximum number of theses among thrust areas under each PC group which were identified and presented in table 11 and table 12 for period 2011-2014 and 2015-2017 respectively.

4.2.2 Thrust areas of PhD research under each PC group

It refers to categorisation of thrust areas that were studied in the research works for two periods 2011 to 2014 and 2015 to 2017 the results were presented in table 11 and table 12 respectively.

From this cursory investigation of results in table 11 and table 12 it can be reflected that from period 2011-2014 highest number of theses (eight) were recorded from thrust area under Plant Protection (PP) PC group whereas from 2015-2017 highest number (four) was from Rice (R) project coordination group. Over the years, it was clearly shown that during 2015-2017, number of untouched thrust areas increased slightly though PC groups decreased compared to period from 2011-2014 that may be because of less number of research studies or enrolment of doctoral students during that period. The list of untouched thrust areas can be observed from appendix II.

Table 11: Thrust areas of PhD research under each PC group for period of 2011-2014

Code	Thrust area	Maximum
	PC GROUP 1: RICE AND RICE BASED CROPPING SYSTEM (RBC)	**n=5**
RBC 4	Development of location specific agro techniques- specialized crop techniques, rice-fish culture and others	2
RBC 14	Molecular markers for yield, quality and resistance to biotic and abiotic stresses	2
RBC 16	Unravelling factors limiting productivity of rice in different soils and ecosystems and formulation of technologies	1
	PC GROUP 2: COCONUT AND OTHER PALMS (COP)	**n=1**
COP 7	Management of pest and disease problems	1
	PC GROUP 3: VEGETABLES	**n=6**
VEG 1	Breeding in solanaceous vegetables for- yield, quality, biotic stress, resistance to biotic stress	3
VEG 12	Hi-tech production package with special reference to protected cultivation and precision	1
VEG 13	Hybrid and high tech production	2
	PC GROUP 4: SUGAR AND TUBER CROPS	**n=2**
STC 5	Trade oriented production of tuber crops through diversification and development of value added products	1
STC 10	Constraint analysis and strategies for breaking yield barriers in tuber crops viz. cassava, sweet potato and tannia	1
	PC GROUP 5: FRUITS	**n=2**
FR 7	High-tech innovative fruit culture(high density planting, fertigation, use of bio regulators, protected cultivation, roof top cultivation, canopy regulation and tree size control *etc.*)	1
FR 8	Management practices including fertigation for high productivity	1
	PC GROUP 6: FLORICULTURE	**n=4**

FL 1	Germplasm collection, conservation, evaluation and improvement of export oriented flowers, foliage, aquatic plants and other plants of ornamental value	1
FL 3	Standardization of protected cultivation technology in cut flowers and foliage	1
FL 11	Traditional flowers	1
FL 14	Creation of novel genotypes through *in vitro* mutagenesis	1
	PC GROUP 10: AROMATIC AND MEDICINAL PLANTS (AMP)	**n=2**
AMP 8	Development of cultivation practices for high value medicinal plants suitable for the State	1
AMP 9	Development of neutraceutical products of commerce from medicinal plants	1
	PC GROUP 11: SOILS AND AGRONOMY (SA)	**n=6**
SA 1	Fundamental studies on soils and climatic factors in relation to crop growth	2
SA 7	Soil fertility evaluation techniques and integrated plant nutrient management	2
SA 12	Bioremediation of toxicity in soil and water	1
	PC GROUP 12: PLANT PROTECTION	**n=8**
PP 4	Strategy for pest, nematode and disease management	1
PP 9	Alternate methods for managing insect pest, diseases nematodes and weeds as a substitute for banned chemicals Kerala	7
	PC GROUP 13: BIOTECHNOLOGY	**n=2**
BT 4	Molecular marker analysis	1
BT 5	Genomics and proteomics	1
	PC GROUP 14: POST-HARVEST TECHNOLOGY	**n=2**
PHT 13	Product development for bulk use and technologies for enhancing shelf life in major perishable fruits	2
	PC GROUP 15: AGRICULTURAL EXTENSION and DEVELOPMENT STUDIES	**n=4**
AEDS 4	Participatory approaches for sustainable agricultural development	1

AEDS 9	Knowledge management and ICT in agriculture	1
AEDS 12	Innovations in resources and crisis management in agriculture for poverty alleviation	1
AEDS 15	Research on transfer of technologies	1
	PC GRUP 16: BENEFICIAL ORGANISMS (BO)	**n=2**
BO 6	Mushrooms as food, medicine and bioconversion agents	1
BO 13	Newer strains of edible and medicinal mushroom	1
	PC GROUP 17: FOOD SCIENCE and NUTRITION	**n=2**
FSN 7	Diet in health and diseases	1
FSN 11	Value addition and quality evaluation of foods and food products	1
	PC GROUP 18: ORGANIC FARMING (OF)	**n=2**
OF 10	Strategies for sustainable organic farming in Kerala	1
OF 13	Revalidation of traditional practices in agriculture	1
	PC GROUP 21: NATURAL RESOURCE MANAGEMENT (NRM)	**n=3**
NRM 1	Monitoring of natural resource degradation and adaptation to mitigate its adverse effects on agricultural production systems	2
NRM 5	Integrated input management for sustained soil health and crop productivity	1
	PC GROUP 22: CROP PHYSIOLOGY and BIOCHEMISTRY	**n=1**
CPB 1	Stress physiology-physiological basis of crop responses to biotic stresses, abiotic stresses and crop resilience to climate change	1

Table 12: Thrust areas of PhD research under each PC group for period of 2015-2019

Code	Thrust area	Maximum
	PC GROUP 1: RICE	**n=4**
R 3	Research on hybrid rice, transgenic rice and speciality rice	1
R 4	Development of location specific agro techniques for sustainable rice production	1

R 5	Management of biotic stresses	2
	PC GROUP 3: VEGETABLES	**n=2**
VEG 2	Development of vegetable varieties with resistance to major biotic and abiotic stresses	1
VEG 3	Development of packages for protected cultivation / precision farming for high productivity	1
	PC GROUP 4: FRUITS	**n=2**
FR 3	Refinement of propagation and management methods	1
FR 14	Influence of climatic variations in the performance of fruit crops	1
	PC GROUP: 5 FIELD CROPS – CEREALS (OTHER THAN RICE), MILLETS, PULSES, OIL SEEDS, FODDER CROPS AND GREEN MANURE CROPS	**n=2**
FC 18	Identifying high quality fodder crops / varieties	2
	PC GROUP: 7 AROMATIC AND MEDICINAL PLANTS	**n=1**
AMP 3	Nursery and agro techniques in Medicinal & Aromatic Plants	1
	PC GROUP 8: BIOTECHNOLOGY, BIOCHEMISTRY & PLANT PHYSIOLOGY	**n=2**
BBBP 4	Genome, Transcriptome, proteome metabolome and phenome analysis	1
BBBP 9	Physiological basis of crop response and resilience to climate change	1
	PC GROUP 9: SOIL HEALTH AND ORGANIC FARMING	**n=3**
SHOF 2	Soil Fertility evaluation and nutrient management for sustaining soil health and yield maximization	1
SHOF 7	Waste management for improving soil health and productivity	1
SHOF 9	Organic farming and good agricultural practices for soil health and safe food production	1
	PC GROUP 10: FARMING SYSTEM RESEARCH AND CLIMATE STUDIES	**n=1**

FSRCS 9	Crop weather studies, meteorological parameter interactions and forecasting/simulation models	1
	PC GROUP 11: CROP PESTS AND BENEFICIAL INSECTS	**n=1**
CPBI 4	Pesticide toxicology	1
	PC GROUP 12: PLANT PATHOGENS AND BENEFICIAL MICROBES	**n=1**
PPBM 6	Mushroom production technology and its application in biodegradation, nutraceuticals and pharmaceuticals	1
	PC GROUP 14: FOOD SCIENCE AND NUTRITION	**n=1**
FSN 2	Nutritional problems of the community	1
FSN 6	Bio active components in foods – Antioxidants and phytochemicals	1
	PC GROUP 15: AGRICULTURAL ECONOMICS, AGRICULTURAL STATISTICS AND AGRIBUSINESS MANAGEMENT	**n=1**
AESBM 4	Natural resources and environmental economics	1

4.2.3 Number of Objectives

Objectives in the study refer to the research objectives that were set forth for the study and were mentioned in the theses. The results based on number of objectives were delineated in terms of quartiles under crop production, crop protection, crop improvement, social science and community science divisions in the table 13.

From the table 13, it can be observed that among crop production theses, irrespective of departments there exists a medium level (3-4) of objectives with highest percentage (66.67%), followed by low range (18.18%) and high range category with 15.15 per cent. In terms of crop protection division, it was found that highest percentage (75.00%) of theses has medium range of objectives (2-4) followed by high range (>4) with 25.00 per cent and no studies under low range (<2) category.

Table 13: Distribution of PhD theses based on number of objectives

Division	Category	Class limit	f	%	Total f	Total %
Crop production n=33	**Low**	<3	6	18.18	33	100.00
	Medium	3-4	22	66.67		
	High	>4	5	15.15		
Crop protection n=12	**Low**	<2	0	00.00	12	100.00
	Medium	2-4	9	75.00		
	High	>4	3	25.00		
Crop improvement n=20	**Low**	<2	3	15.00	20	100.00
	Medium	2-3	14	70.00		
	High	>3	3	15.00		
Social science n=5	**Low**	<2	0	00.00	5	100.00
	Medium	2-4	5	100.00		
	High	>4	0	00.00		
Community science n=4	**Low**	<2	0	00.00	4	100.00
	Medium	2-3	4	100.00		
	High	>3	0	00.00		
Total N=74	**Low**	<2	3	4.06	74	100.00
	Medium	2-4	61	82.43		
	High	>4	10	13.51		

Likewise, in crop improvement theses 70.00 per cent of studies fell under medium range (2-3) followed by 15.00 per cent each in low (<2) and high (>3) range categories. In case of social science division, it was interesting to note that all the theses belonged to medium range (2-4) of categories with 100.00 per cent. Under community science division, 82.43 per cent of theses belonged to medium category (2-3) followed by 13.51 per cent under high category (>3) and 4.06 per cent under low category (<2).

An overall analysis of theses irrespective of divisions indicates that 82.43 per cent of theses possessed medium range (2-4) of objectives with 13.51 per cent in high range category (>4) and 4.06 in low range (<2) category.

From summarised table based on number of objectives, it can be inferred that majority of the theses (32.43%) had ‘two’ research objectives in their study followed by 28.38 per cent theses with ‘three’ objectives, 21.62 per cent studies with ‘four’ objectives, 6.76 per cent each with ‘five’ and ‘six’ objectives, 4.05 per cent theses with ‘one’ objective in their research works. This is in partial agreement with study of Liebano *et al.* (2005).

In conclusion, more than one objective for the study may be because the research work was expounded and have more than one conclusion having to study large number of variables. Typically, it is advised to have 2-3 objectives that could be fulfilled in the limited time frame of study for doctoral research.

Table 14: Summarisation of number of objectives in doctoral theses

No. of Objectives	Frequency	Percentage
1	3	4.05
2	24	32.43
3	21	28.38
4	16	21.62
5	5	6.76
6	5	6.76
Total	74	100.00

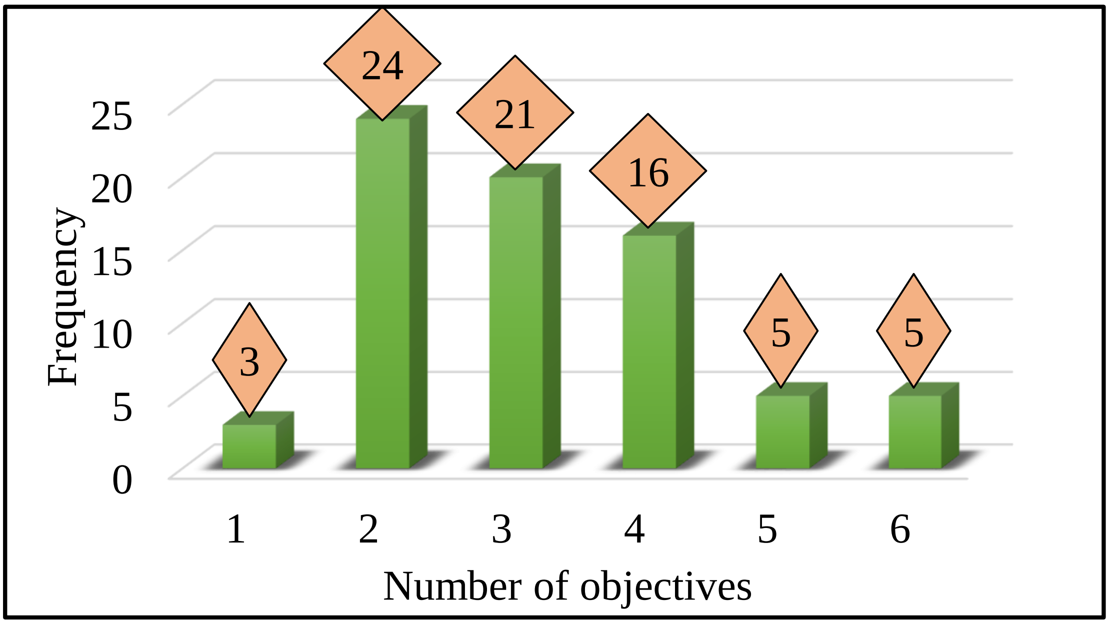


Fig. 11: Distribution of PhD theses based on number of objectives

4.2.4 Number of References

References in this study was defined as to the list of all the sources from which the researchers attained evidence for their research study which was signified in the last pages of each thesis. The results illustrated in table 15, 16, 17, 18 and 19 represents the distribution of theses based on number of references under crop production, crop protection, crop improvement, social science and community science divisions respectively in terms of mean and standard deviation as check.

Table 15: Distribution of crop production theses based on number of references

Category	Agronomy n=14			SSAC n=8			Horticulture n=11			Total N=33	
	Class limits	f	%	Class limits	f	%	Class limits	f	%	f	%
Low (M-SD)	<158	2	14.29	<191	2	25.00	<123	0	00.00	4	12.12
Medium (M±SD)	158-340	10	71.42	191-326	5	62.50	123-383	9	81.82	24	72.72
High (M+SD)	<340	2	14.29	>326	1	12.50	>383	2	18.18	5	15.15
Total		14	100.00		8	100.00		11	100.00	33	100.00
	Mean= 249.07 SD= 90.96 Min-Max= 122-410			Mean= 259.36 SD= 67.43 Min-Max=174-343			Mean= 252.73 SD= 130.14 Min-Max=151-464				

Department wise results in table 15 showed that 71.42 per cent of Agronomy theses have medium number of references followed by 62.5 per cent in SSAC and 81.82 per cent in Horticulture theses. The table also shows that 25.00 per cent of SSAC theses have low number of references followed by 14.29 per cent in Agronomy. About 18.18 per cent of Horticulture theses recorded having high number of references followed by 14.29 per cent in Agronomy theses and 12.50 per cent in SSAC theses respectively.

Hence, it can be reflected that irrespective of different departments under crop production, 72.72 per cent of theses had medium number of references followed by 15.15 per cent and 12.12 per cent in high and low category respectively. In conclusion, it can be said that horticulture topped the list with having high number of references. The minimum (122) and maximum (464) number of references were observed in Agronomy and Horticulture respectively.

Table 16: Distribution of crop protection theses based on number of references

Category	Plant Pathology n=6			Agricultural Entomology n=6			Total N=12	
	Class limits	f	%	Class limits	f	%	f	%
Low (M-SD)	<174	1	16.67	<172	2	33.33	3	25.00
Medium (M±SD)	174-505	4	66.66	172-274	3	50.00	7	58.33
High (M+SD)	>505	1	16.67	>274	1	16.67	2	16.67
Total		6	100.00		6	100.00	12	100.00
	Mean= 339.67; SD= 165.77; Min- Max= 159-617			Mean= 223.1667; SD= 50.6415; Min-Max=161-277				

On examination of table 16, it can be detected that irrespective of different departments under crop protection division, 58.33 per cent of theses belonged under medium category of number of references followed by 25.00 per cent and 16.67 per cent in low and high category respectively. By glance we can observe that medium category listed more theses with 66.66 per cent and 50.00 per cent in Plant Pathology and Agricultural Entomology department respectively. It also shows that theses accounting 16.67 per cent of each in Plant Pathology and Agricultural Entomology department respectively were found to have high number of references. Agricultural Entomology theses found to top the list in low category with 33.33 per cent followed by 16.67 per cent in Plant Pathology theses.

Therefore, it can be inferred that majority of crop protection theses regardless of departments were having medium category of references where plant pathology topped the list with 66.66 per cent and followed by Agricultural Entomology with 50.00 per cent. The minimum (159) and maximum (617) number of references were from Plant Pathology and Agricultural Entomology respectively.

Table 17: Distribution of crop improvement theses based on number of references

	Plant Physiology n=5			PBG n=13			PBT n=2			Total N=20	
	Class limits	f	%	Class limits	f	%	Class limits	f	%	f	%
Low (M-SD)	<106	0	00.00	<147	0	00.00	<179	0	00.00	0	00.00
Medium (M±SD)	106-415	4	80.00	147-329	11	84.62	179-441	2	100.00	17	85.00
High (M+SD)	>415	1	20.00	>329	2	15.38	>441	0	0.00	3	15.00
		5	100.00		13	100.00		2	100.00	20	100.00
	Mean=260.8; SD= 154.25 Min-Max=139-521			Mean= 238.15; SD= 91.35 Min-Max=152-489			Mean= 309.90; SD= 130.82 Min-Max=204-389				

From table 17, regardless of different departments it can be observed that 100.00 per cent of theses contained medium number of references in Plant Biotechnology followed by 84.62 per cent in Plant Breeding and Genetics and 80.00 per cent in Plant Physiology under crop improvement division.

Department wise results reflected that 80.00 per cent of theses belonged to medium category followed by 20.00 per cent in high category in Plant Physiology department. Likewise, 84.62 per cent theses were found in medium range and 15.38 per cent in high category in Plant Breeding and Genetics department. In case of theses in Plant Biotechnology, 100.00 per cent theses were recorded in medium category. It was interesting to note that none of the theses were categorised in low category in all departments under crop improvement division.

Therefore, it can be abridged that irrespective of change in departments majority of the theses had medium number of references (85.00%) followed by high number of references (15.00%). One hundred and thirty-nine (139) to four hundred and eighty-nine (489) was the minimum and maximum number of references recorded in Plant Physiology and Plant Breeding and Genetics respectively.

Table 18: Distribution of social science theses based on number of references

Agricultural Economics (N=1) = 209

Agricultural Extension (N=4):

Category	Agricultural Extension N=4		
	Class limits	f	%
Low (M-SD)	<169	1	25.00
Medium (M±SD)	169-211	3	75.00
High (M+SD)	>218	0	00.00
Total		4	100.00
Mean= 194.75; SD= 23.68; Min-Max=168-218			

Table 19: Distribution of community science theses based on number of references

Category	Community Science N=4		
	Class limits	f	%
Low (M-SD)	<339	0	00.00
Medium (M±SD)	339-575	3	75.00
High (M+SD)	>575	1	25.00
Total		4	100.00
Mean= 457; SD= 118.01; Min-Max=344-610			

From table 18 showing distribution of social science theses based on number of references, it clearly stated that with only one thesis studied under Agricultural Economics the number of references were two hundred and nine (209). In case of

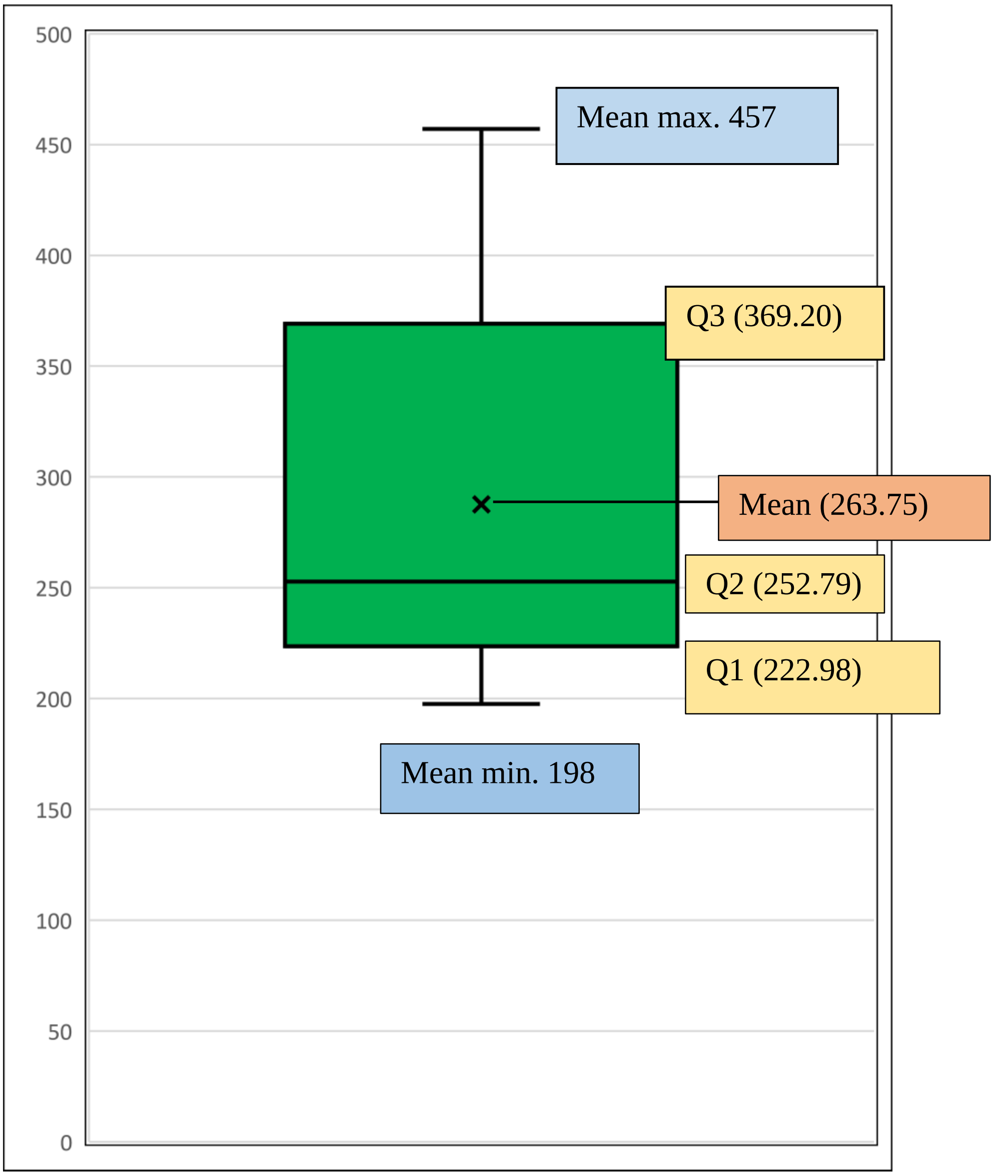


Fig.12: Box plot representation of theses based on mean number of references

Agricultural Extension, 75.00 per cent of theses had medium range of references (169-211) followed by 25.00 per cent in low range (<169).

Hence, from this analysis it can be concluded that none of the Agricultural Extension theses fell under high range category and listed medium range of references more in those studies. The minimum (168) and maximum (218) were observed both from Agricultural Extension department.

On perusal of data from table 19, about 75.00 per cent of theses in Community Science department were having medium number of references and 25.00 per cent of theses have high number of references. The range for medium number of references is 339-575 with minimum (344) and maximum (610) number of references in Community Science department.

The number of references were categorised based on mean and standard deviation as check. The overall results were summarised based on mean number of references using quartiles and illustrated in table 20.

Table 20: Summarisation of results based on mean number of references in Ph.D. theses of all divisions using quartiles

Category	Class Limits	f	%
Low	<223	1	20.00
Medium	223-369	4	80.00
High	>369	0	00.00
Divisions			
Low	Social science		
Medium	Crop production, Crop protection, Crop improvement and Community science		
High	None		
Q1=222.98, Q2=252.79, Q3=369.20; Min- Max=198-457 ; Mean=263.75			

Table 20 results revealed that researches under social science division fall under low category with less than 223 references whereas remaining divisions like crop production. crop protection, crop improvement and community science fall under medium category with range 223-369 references.

Hence, a conclusion can be drawn from fig. 12 that mean minimum (198) and mean maximum (457) number of references were recorded from Social Science and Community Science division respectively but in terms of entire theses it was observed that minimum and maximum number of references were 122 and 617 which were recorded from Agronomy and Plant Pathology departments respectively.

4.2.5 References Based on Years

References based on years in this study refers to as year in which the sources of references were published. The results respective to distribution of references based on years under each division are presented in table 21 and in fig.13.

Division wise analysis of results showed that about 77.94 per cent of the references were published after 2000 under Social Science followed by 75.38 per cent in Community Science, 66.39 per cent in crop production, 64.32 per cent and 57.04 per cent from crop protection and crop improvement division respectively. Greater than 20 per cent of references were recorded from all the divisions during 1976-2000. During 1951-1975, 6.52 per cent of references were from crop production followed by 6.35 per cent from crop improvement, 4.06 per cent from crop protection, 2.35 from Community Science and 1.22 per cent from Social Science. About 1.30 per cent, 1.10 per cent, 0.59 per cent, 0.30 per cent and 0.22 per cent of the references were from crop improvement, crop production, crop protection, social science and Community Science respectively. Less than 1 per cent of references were listed from all divisions except Community Science during 1901-25 and below 1900s and also social science theses did not refer any publications below 1900s. Less than 1 per cent of theses from all divisions except crop improvement has publications that were not dated in references.

Overall analysis from table 21 and fig.13 shows that 65.07 per cent of references were published after 2000 followed by 28.08 per cent from 1976-2000, 5.39 per cent from 1951-1975, 0.94 per cent from 1926-1950, 0.32 per cent from 1901-1925, and 0.11 per cent before 1900s among all the divisions. 0.09 per cent of references among all theses had publications that were not dated.

Table 21: Distribution of theses references based on year under each division

Category	Crop production n=33		Crop protection n=12		Crop improvement n=20		Social Science n=5		Community science n=4		Total N=74	
	f	%	f	%	f	%	f	%	f	%	f	%
Below 1900	3	0.04	15	0.44	4	0.08	0	00.00	0	00.00	22	0.11
1901-25	15	0.18	20	0 .59	26	0.52	1	0.10	0	00.00	62	0.32
1926-50	92	1.10	20	0.59	65	1.30	3	0.30	4	0.22	184	0.94
1951-75	544	6.52	137	4.06	317	6.35	12	1.22	43	2.35	1050	5.39
1976-2000	2141	25.67	1011	29.94	1733	34.71	199	20.14	399	21.83	5445	28.08
2001 and above	5538	66.39	2172	64.32	2848	57.04	770	77.94	1378	75.38	12473	65.07
Not Dated	9	0.10	2	0.06	0	00.00	3	0.30	4	0.22	18	0.09
Total	8342	100.00	3377	100.00	4993	100.00	988	100.00	1828	100.00	19254	100.00

Therefore, a conclusion can be drawn that more than 50 per cent of references were from publications published after 2000 inferring that researchers referred latest information most for conducting their research.

4.2.6 Type of Research Design

Research design in this study was operationalised as set of procedures or methods used in collecting and analysing measures of variables in the problem research. The results observed after examining the different research designs followed by researchers during their research are illustrated in tables 22, 23, 24, 25 and 26 under each division.

Table 22: Distribution of crop production theses based on type of research design followed

Sl.No.	Type of Research design	Agronomy n=14		SSAC n=8		Horticulture n=11		Total n=33	
		f	%	f	%	f	%	f	%
1	RBD	11	50.00	4	40.00	4	26.66	19	40.42
2	CRD	3	13.65	5	50.00	6	40.00	14	29.79
3	Split plot	7	31.81	0	00.00	1	6.67	8	17.02
4	Factorial RBD	1	4.54	0	00.00	1	6.67	2	4.26
5	Factorial CRD	0	00.00	0	00.00	3	20.00	3	6.38
6	LSD	0	00.00	1	10.00	0	00.00	1	2.13
	Total	22	100.00	10	100.00	15	100.00	47	100.00

On examining table 22 belonging to crop production theses, various research designs identified were Randomized Block Design (RBD), Completely Randomized Design (CRD), split plot design, factorial-RBD, factorial-CRD and Lattice Square Design (LSD) among which 40.42 per cent of theses used RBD design followed by 29.79 per cent used CRD, 17.02 per cent used split plot design, 6.38 per cent used factorial-CRD and 4.26 per cent used factorial-RBD.

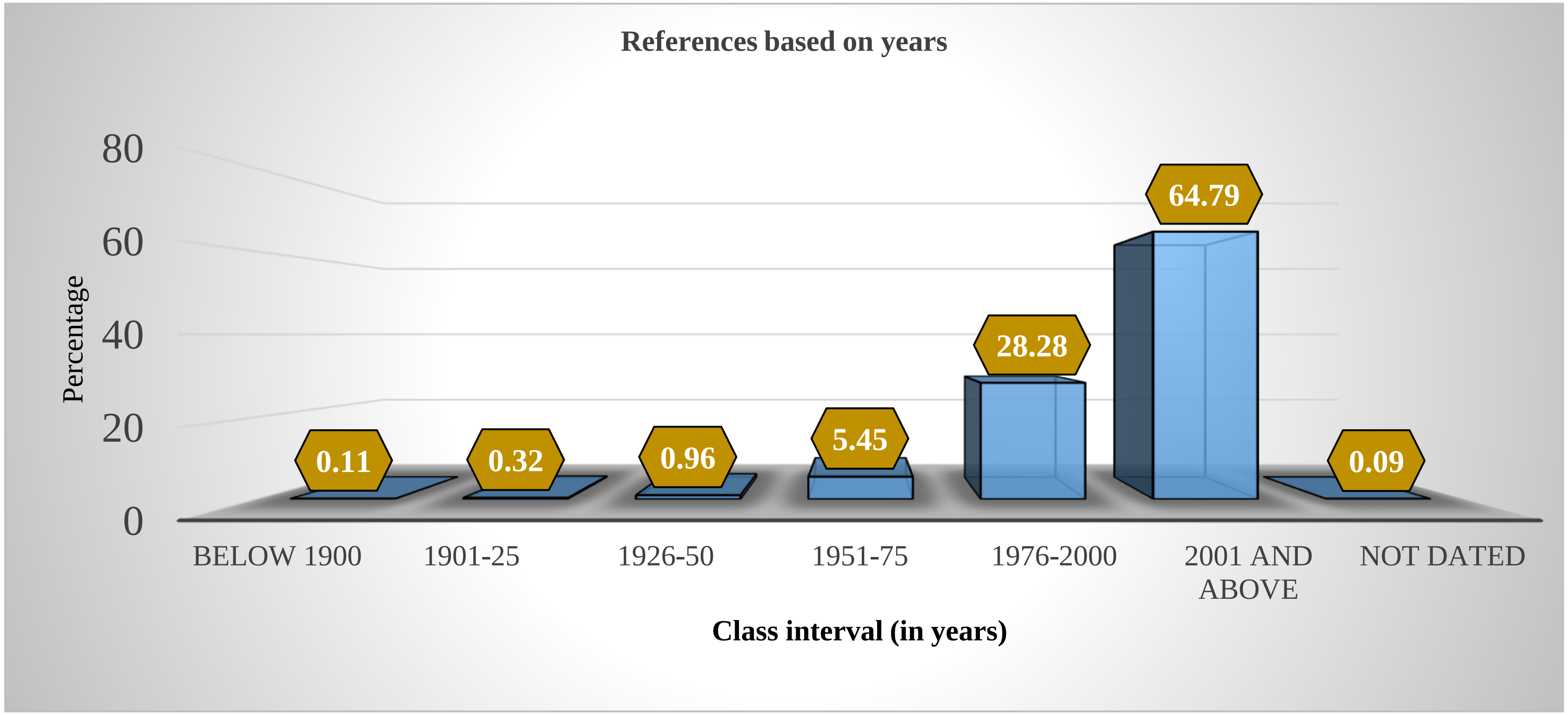


Fig. 13: Distribution of theses references based on years

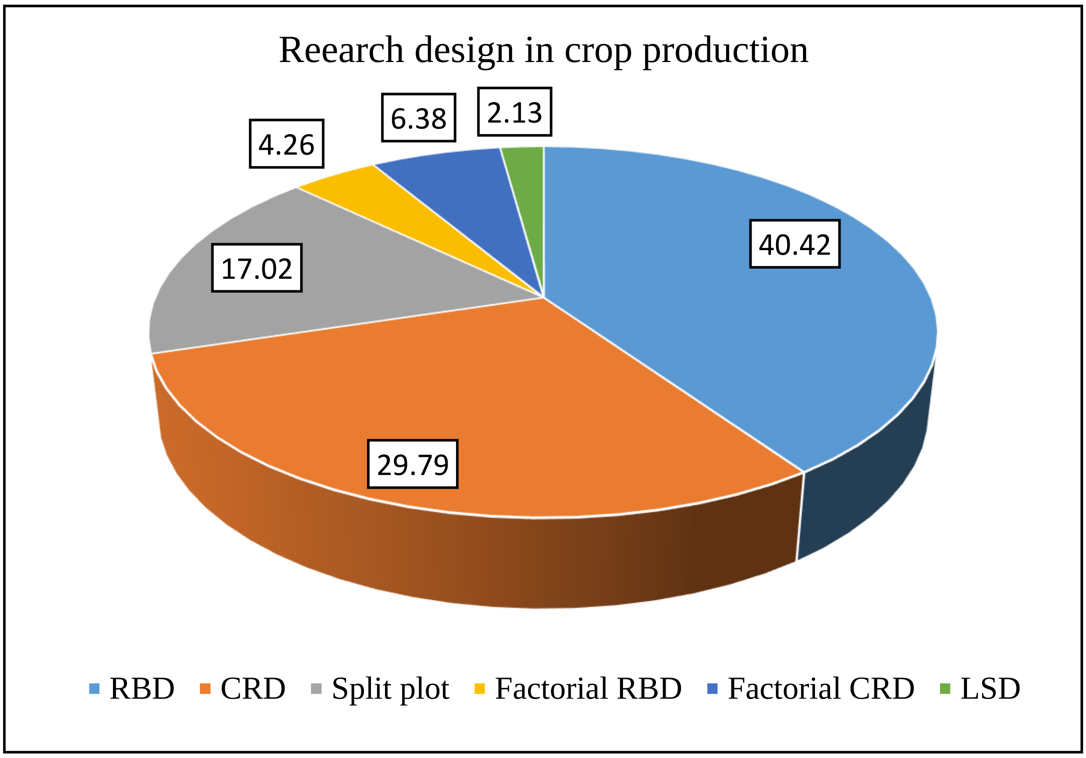


Fig. 14: Percentage distribution of research design used in crop production division

Looking into results of each department, it was revealed that 50.00 per cent of Agronomy theses used RBD design followed by 40.00 per cent in SSAC and 26.66 per cent in Horticulture theses. It was also noticed that 50 per cent of SSAC theses used CRD followed by 40.00 per cent in Horticulture department and 13.65 per cent theses in Agronomy. About 31.81 per cent and 6.67 per cent theses of Agronomy and Horticulture department followed split plot design respectively. Likewise, 6.67 per cent and 4.54 per cent of theses from Horticulture and Agronomy department followed factorial-RBD respectively. About 20.00 per cent of Horticulture theses used factorial-CRD and 10.00 per cent of theses from SSAC department used LSD.

Hence, it can be concluded that more than 50 per cent of studies from Agronomy and SSAC department conducted experiments in field (farmers and others) using RBD, factorial-RBD, split plot design and LSD respectively. About 50.00 per cent of SSAC research works were conducted in laboratory or pot culture or greenhouse using CRD and factorial-CRD. The results from Horticulture department revealed that 60 per cent of studies followed CRD and factorial-CRD for laboratory or pot culture experiment while 40 per cent conducted field experiments using RBD, split plot and factorial-RBD.

Table 23: Distribution of crop protection theses based on type of research design followed

Sl.No.	Type of Research design	Plant Pathology n=6		Agricultural Entomology n=6		Total n=12	
		f	%	f	%	f	%
1	RBD	2	25.00	4	44.45	6	35.30
2	CRD	5	62.50	3	33.33	8	47.06
3	Factorial CRD	0	00.00	2	22.22	2	11.76
4	Not mentioned	1	12.50	0	00.00	1	5.88
	Total	8	100.00	9	100.00	17	100.00
*Not mentioned means “unique and independent” in this study							

Table 23 results showed that 47.06 per cent of theses used Completely Randomized Design (CRD) followed by 35.30 per cent used Randomized Block Design (RBD), 11.76 per cent used factorial CRD and 5.88 per cent of studies did not mention the design used for the study.

Department wise analysis of results elucidated that among Plant Pathology theses, 62.50 per cent of theses followed CRD to conduct laboratory or pot culture experiments whereas 25.00 per cent studies followed RBD to perform field experiments and 12.50 per cent of studies did not mention the research design followed. In Agricultural Entomology department, 44.45 per cent of theses conducted field experiments using RBD whereas 33.33 per cent and 22.22 per cent of studies conducted laboratory or pot culture or greenhouse experiments using CRD and factorial-CRD respectively.

Hence, it can be inferred that regardless of different departments in crop protection division more than 50 per cent of researches were conducted either in laboratory, pot culture or greenhouse using CRD and factorial-CRD and only 44.45 per cent of researches conducted field level experiment using RBD.

From table 24 it was interesting to note that 40.91 per cent of research works followed Randomized Block Design (RBD) and Completely Randomized Design (CRD) respectively followed by 18.18 per cent of theses did not mention the design followed in those studies.

Considering department alone it can be seen that 80.00 per cent of Plant Physiology theses used CRD to conduct laboratory or pot culture experiment and remaining 20.00 per cent of theses did not mention research design followed. Under Plant Breeding and Genetics department, it was noticed that 60.00 per cent of researches used RBD in field experiment followed by 33.34 per cent used CRD for laboratory, pot culture or greenhouse experiments and 6.66 per cent studies did not mention type of research design followed. Looking into Plant Biotechnology department, 100.00 per cent theses did not specify type of research design followed in their laboratory experiment.

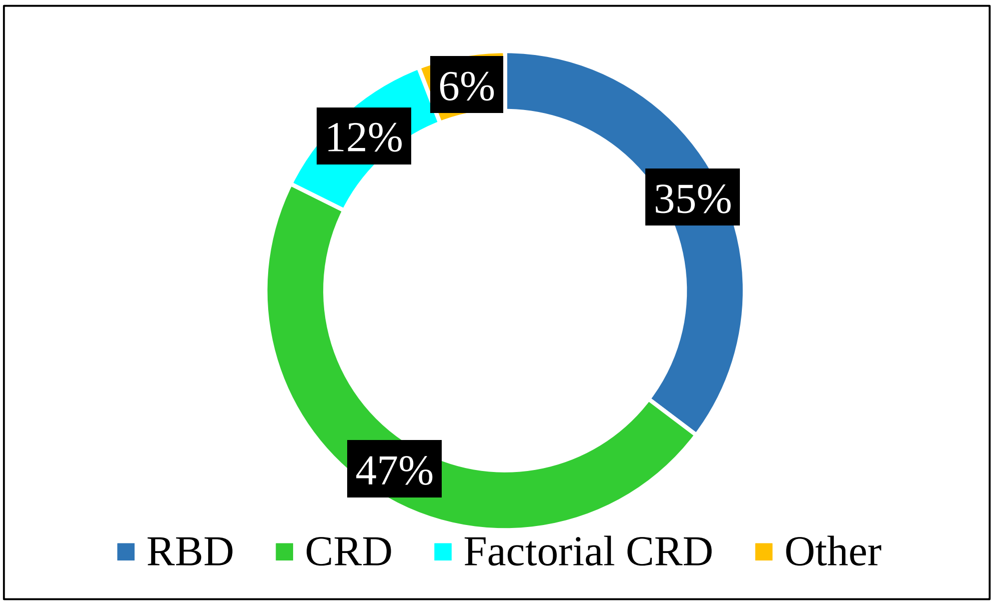


Fig. 15: Percentage distribution of research design used in crop protection division

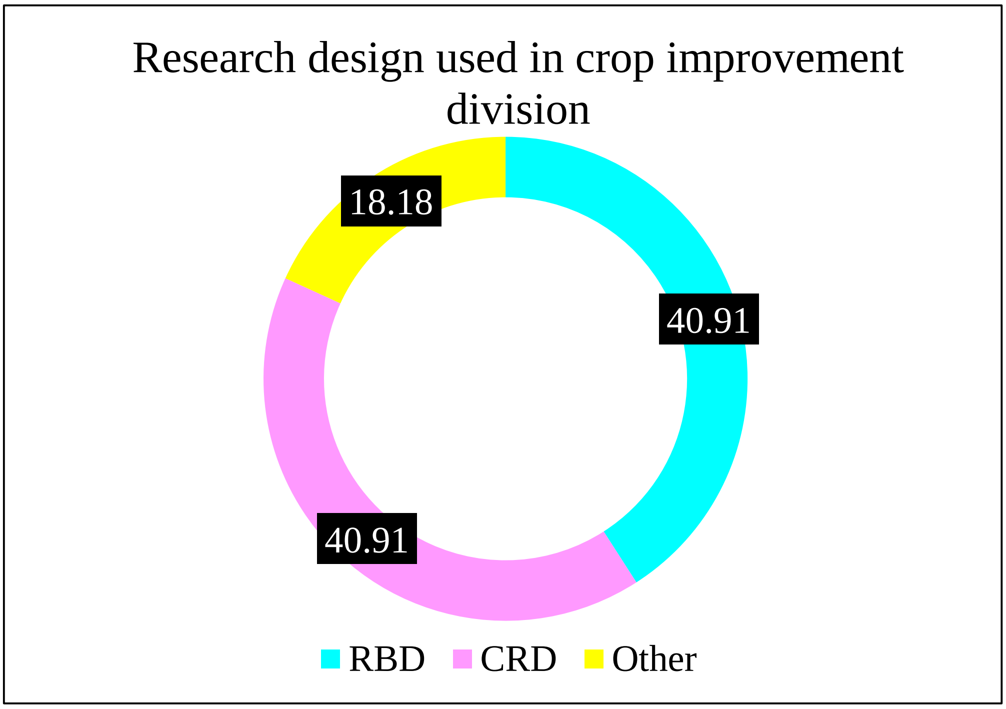


Fig.16: Percentage distribution of research design used in crop improvement division

Table 24: Distribution of crop improvement theses based on type of research design followed

Sl.No.	Type of Research design	Plant Physiology n=5		PBG n=13		PBT n=2		Total N=20	
		f	%	f	%	f	%	f	%
1	RBD	0	00.00	9	60.00	0	00.00	9	40.91
2	CRD	4	80.00	5	33.34	0	00.00	9	40.91
3	Not mentioned	1	20.00	1	6.66	2	100.00	4	18.18
	Total	5	100.00	15	100.00	2	100.00	22	100.00
*Not mentioned means "unique and independent" in this study									

Table 25: Distribution of social science theses based on type of research design followed

Sl.No.	Type of Research design	Agricultural Economics n=1		Agricultural Extension n=4		Total N=5	
		f	%	f	%	f	%
1	Exploratory	0	00.00	2	50.00	2	40.00
2	Ex Post Facto	1	100.00	2	50.00	3	60.00
	Total	1	100.00	4	100.00	5	100.00

On perusal of data from above table it was revealed that 50.00 per cent of Agricultural Extension theses used exploratory and ex-post facto design respectively whereas Agricultural Economics thesis used ex-post facto design (100.00%). Hence, it can be inferred that among the research designs used for the study, majority (60.00%) of social science researches were based on examining past incidents in order to understand a current situation.

Table 26: Distribution of community science theses based on type of research design followed

Sl.No.	Type of Research design	Community Science n=4	
		f	%
1	CRD	2	50.00
2	Ex Post Facto	2	50.00
	Total	4	100.00

It can be inferred from table 26 that 50.00 per cent of research works under Community Science division followed Completely Randomised Design (CRD) and ex-post facto design indicating that researches were conducted in laboratory and as survey study respectively.

Some reviews revealed that doctoral research usually orient towards quantitative experiments as they are easy to collect, interpret and analyse the results rather than qualitative studies as in crop production, crop protection and crop improvement theses primarily focusing in field, laboratory, pot culture or greenhouse conditions. Social science researches mainly focused on qualitative type of researches focusing on survey type of studies.

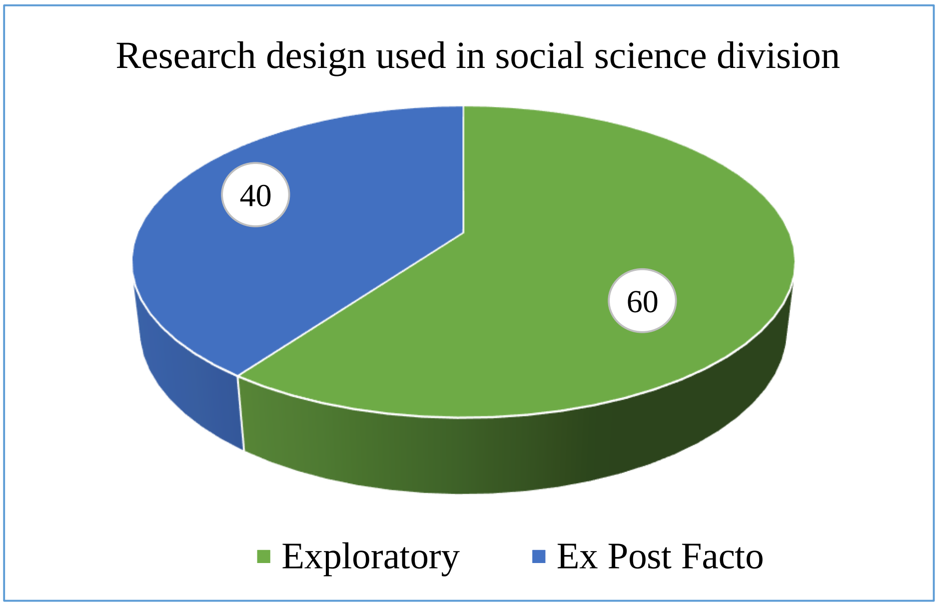


Fig. 17: Percentage distribution of research design used in social science division

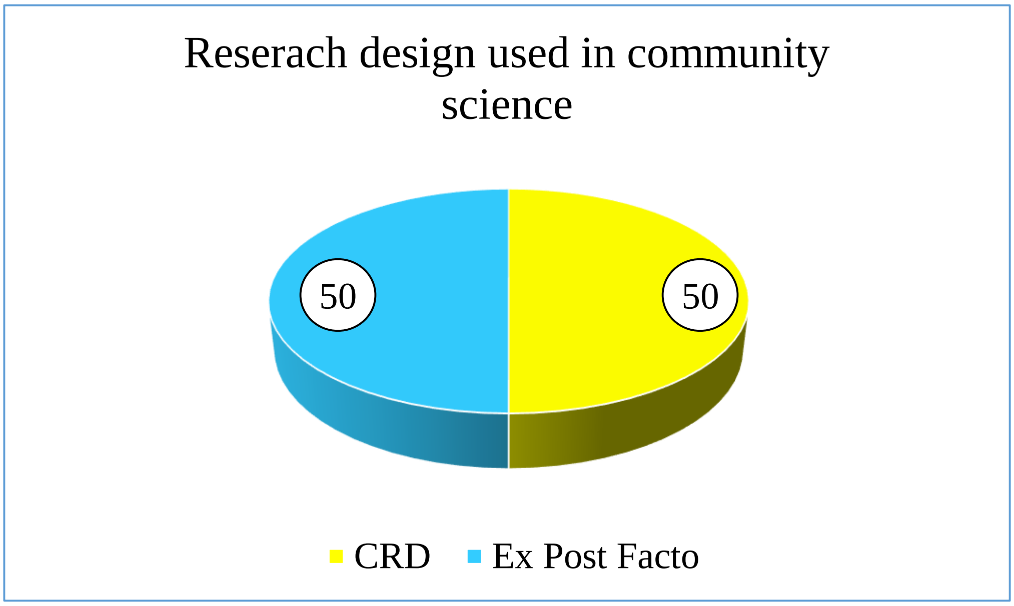


Fig.18: Percentage distribution of research design used in community science

4.2.7 Statistical methods used

Statistical methods refer to various statistical tools and techniques that were used for analysing the data of various researches. The results were categorised under different categories based on various statistical tests and methods used by studies in crop production, crop protection, crop improvement, social science and Community Science division was illustrated in table 27, 28, 29, 30 and 31.

Table 27: Distribution of crop production theses based on statistical methods

Sl.No.	Category	Agronomy n=13		SSAC n=8		Horticulture n=12		Total N=33	
		f	%	f	%	f	%	f	%
1	Basic statistics	7	24.14	2	13.33	1	1.67	10	9.62
2	Genetics based statistics	0	00.00	0	00.00	14	23.33	14	13.46
3	Grouping/clustering type analysis	0	00.00	0	00.00	7	11.66	7	6.73
4	Multivariate analysis	0	00.00	0	00.00	3	5.00	3	2.88
5	Non-parametric tests and methods	0	00.00	0	00.00	4	6.67	4	3.85
6	Parametric tests and methods	22	75.86	12	80.00	30	50.00	64	61.54
7	Regression	0	00.00	1	6.67	1	1.67	2	1.92
	Total	29	100.00	15	100.00	60	100.00	104	100.00

On scrutinizing table 27**,** it was revealed that majority (61.54%) of crop production theses used parametric tests and methods followed by genetics based statistics (13.46 %), basic statistics (9.62%), grouping or clustering type analysis (6.73%), non-parametric tests and methods (3.85%), multivariate analysis (2.88%) and regression analysis (1.92%).

Department wise analysis of results showed that 80.00 per cent, 75.86 per cent and 50.00 per cent of theses from SSAC, Agronomy and Horticulture departments respectively used parametric tests and methods. Basic statistics were adopted about 24.12 per cent, 13.33 per cent and 1.67 per cent in Agronomy, SSAC and Horticulture theses respectively. Regarding regression, 6.67 per cent theses in SSAC and 1.67 per cent in Horticulture followed this statistical method. About 23.33 per cent of Horticulture theses used genetics based statistics followed by 11.66 per cent used grouping or clustering type analysis, 6.67 per cent used non-parametric tests and methods and 5.00 per cent used multivariate analysis. Hence, it can be concluded that more than half of the theses used parametric tests and methods under crop production division.

Overall analysis of crop protection division as indicated in table 28 showed that 47.72 per cent theses followed basic statistics as the statistical methods. This was then followed by 34.10 per cent theses that used parametric tests and methods, 11.36 per cent used genetics based statistics, 4.55 per cent used non-parametric tests and methods and 2.27 per cent used grouping or clustering type analysis.

Table 28: Distribution of crop protection theses based on statistical methods

Sl.No.	Category	Plant Pathology n=6		Agricultural Entomology n=6		Total N=12	
		f	%	f	%	f	%
1	Basic statistics	4	25.00	17	60.72	21	47.72
2	Genetics based statistics	3	18.75	2	7.14	5	11.36
3	Grouping/clustering type analysis	1	6.25	0	00.00	1	2.27
4	Multivariate analysis	0	00.00	0	00.00	0	00.00
5	Non-parametric tests and methods	0	00.00	2	7.14	2	4.55
6	Parametric tests and methods	8	50.00	7	25.00	15	34.10
7	Regression	0	00.00	0	00.00	0	00.00
	Total	16	100.00	28	100.00	44	100.00

Results based on department wise reflected that about 50.00 per cent of Plant Pathology theses used parametric tests and methods followed by 25.00 per cent used basic statistics, 18.75 per cent used genetics based statistics and 6.25 per cent used grouping or clustering type analysis. In Agricultural Entomology, 60.72 per cent of theses used basic statistics, 25.00 per cent used parametric tests and methods, 7.14 per cent used genetics based statistics and non-parametric tests and methods respectively.

Hence, it can be inferred that majority of the theses followed basic statistics and parametric tests and methods in both Plant Pathology and Agricultural Entomology.

Table 29 and fig. 21 revealed that majority (33.33%) of theses under crop improvement division used parametric tests and methods then followed by 26.23 per cent used basic statistics, 17.02 per cent used genetics based statistics, 12.06 per cent used grouping or clustering type of analysis, 4.26 per cent used multivariate analysis, 2.84 per cent used non-parametric tests and methods, 2.13 per cent used regression analysis and remaining 2.13 per cent of theses did not specify the statistical methods used.

Department wise analysis revealed that in Plant Physiology, 37.50 per cent theses used parametric tests and methods followed by 25.00 per cent used basic statistics, 18.75 per cent used grouping or clustering type analysis, 6.25 per cent used multivariate analysis and non-parametric tests and methods respectively and 6.25 per cent of theses did not mention statistical method used. Among Plant Breeding and Genetics department theses, 33.33 per cent used parametric tests and methods then followed by 26.82 per cent used basic statistics, 19.51 per cent used genetics based statistics, 11.39 per cent used grouping or clustering type of analysis, 4.07 per cent used multivariate analysis and 2.44 per cent used non-parametric tests and methods and regression analysis respectively. In case of Plant biotechnology department, theses did not specify the statistical methods used in the study.

Table 29: Distribution of crop improvement theses based on statistical methods

Sl.No.	Category	Plant Physiology n=5		PBG n=13		PBT n=2		Total N=20	
1		f	%	f	%	f	%	f	%
2	Basic statistics	4	25.00	33	26.82	0	00.00	37	26.23
3	Genetics based statistics	0	00.00	24	19.51	0	00.00	24	17.02
4	Grouping/clustering type analysis	3	18.75	14	11.39	0	00.00	17	12.06
5	Multivariate analysis	1	6.25	5	4.07	0	00.00	6	4.26
6	Non-parametric tests and methods	1	6.25	3	2.44	0	00.00	4	2.84
7	Parametric tests and methods	6	37.50	41	33.33	0	00.00	47	33.33
8	Regression	0	0.00	3	2.44	0	00.00	3	2.13
9	Not mentioned	1	6.25	0	00.00	2	00.00	3	2.13
	Total	16	100.00	123	100.00	2	100.00	141	100.00

*Not mentioned means “unique and independent” in this study

Hence, it can be inferred that more than 30 per cent and more than 25 per cent of theses in Plant Physiology and Plant Breeding and Genetics used parametric tests and methods and basic statistics respectively.

From table 30 and fig.22**,** it was observed that 59.26 percent researches in social science used basic statistics followed by 18.51 per cent used parametric tests and methods, 14.81 per cent used multivariate analysis and 7.41 per cent used regression.

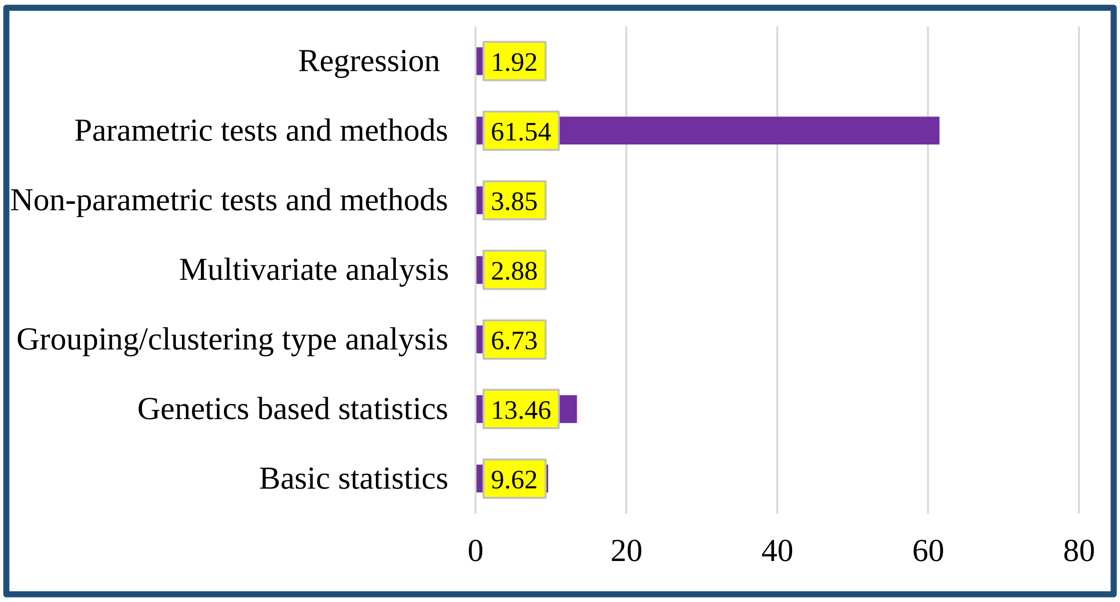


Fig.19: Percentage distribution of statistical methods used in crop production division

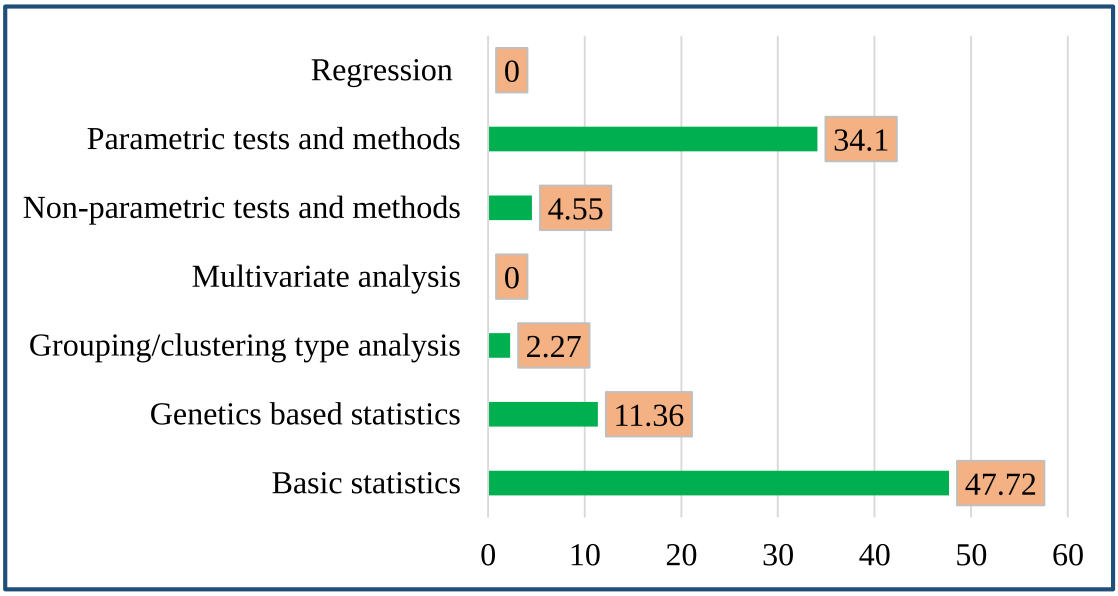


Fig.20: Percentage distribution of statistical methods used in crop protection division

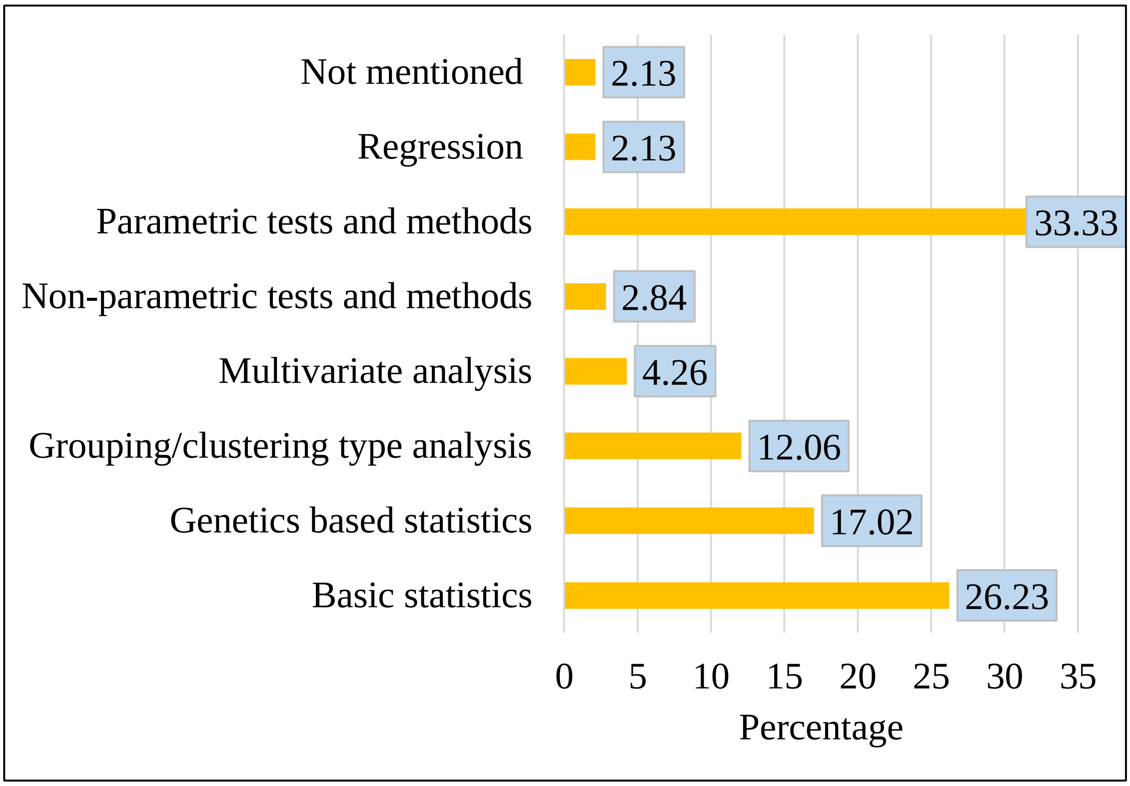


Fig.21: Percentage distribution of statistical methods used in crop improvement division

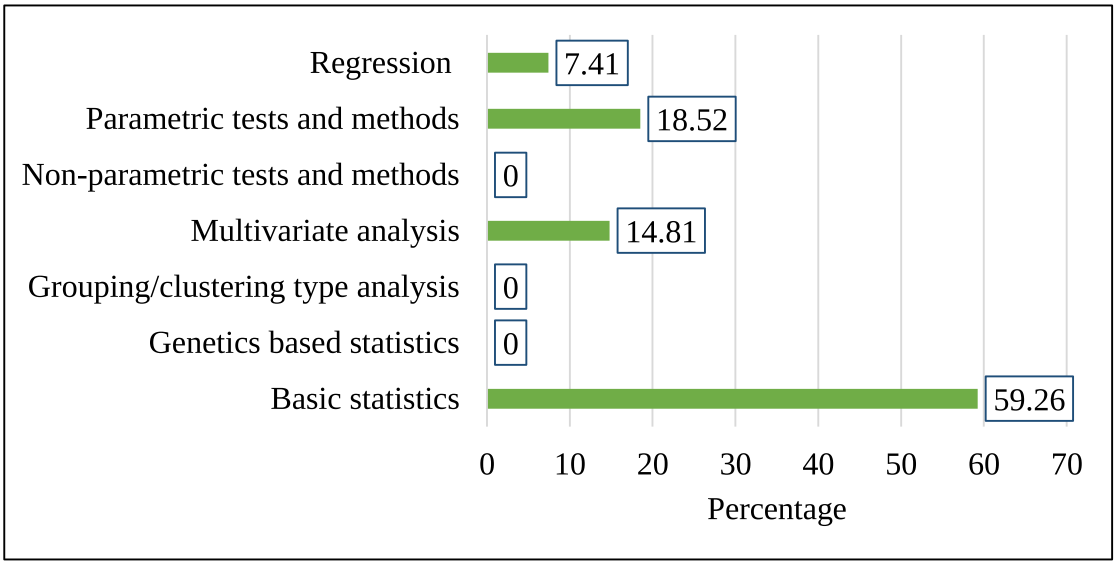


Fig.22: Percentage distribution of statistical methods used in social science division

Table 30: Distribution of social science theses based on statistical methods

Sl.No.	Category	Agricultural Economics n=1		Agricultural Extension n=4		Total N=5	
1		f	%	f	%	f	%
2	Basic statistics	0	00.00	16	64.00	16	59.26
3	Genetics based statistics	0	00.00	0	00.00	0	00.00
4	Grouping/clustering type analysis	0	00.00	0	00.00	0	00.00
5	Multivariate analysis	1	50.00	3	12.00	4	14.81
6	Non-parametric tests and methods	0	00.00	0	00.00	0	00.00
7	Parametric tests and methods	0	00.00	5	20.00	5	18.52
8	Regression	1	50.00	1	4.00	2	7.41
	Total	2	100.00	25	100.00	27	100.00

In Agricultural Economics, 50.00 per cent of research studies used multivariate analysis and regression respectively. In case of Agricultural Extension, 64.00 per cent used basic statistics followed by parametric tests and methods (20.00%) and multivariate analysis (12.99%). Hence, it can be inferred that in social science department more than half per cent of studies conducted used basic statistics followed by parametric tests and methods with more than 15 per cent.

Table 31 showing statistical methods used in Community Science department revealed that majority (35.30%) of the theses used parametric tests and methods followed by non-parametric tests and methods (23.53%), basic statistics (17.65%), regression (11.76%) and multivariate analysis (5.88%).

Table 31: Distribution of Community Science theses based on statistical methods

Sl.No.	Category	Community science N=4	
		f	%
1	Basic statistics	3	17.65
2	Genetics based statistics	1	5.88
3	Grouping/clustering type analysis	0	0.00
4	Multivariate analysis	1	5.88
5	Non-parametric tests and methods	4	23.53
6	Parametric tests and methods	6	35.30
7	Regression	2	11.76
	Total	17	100.00

From above all results presented, it can be concluded that parametric tests and methods (61.54%, 33.33%, 35.30%) was commonly used statistical method category for analysis of theses under crop production, crop improvement and Community Science respectively. Basic statistics (47.72%, 59.26%) were the major statistical method category used in crop protection and social science theses respectively.

A detailed categorisation and analysis of statistical methods used in all the divisions is tabulated under appendix III which helps in identifying the most preferred type of statistical method among all departments and also in identifying new tools and techniques that were applied and to be applied further in researches.

4.2.8 Sample Size

Sample size in this study was operationalised as number of respondents (in survey study) or number of treatments with replications (in field, laboratory, pot culture or greenhouse experiments) selected for the study that was presented in the theses under all the departments. The results regarding the sample size are illustrated in table 32, 33, 34, 35 and 36.

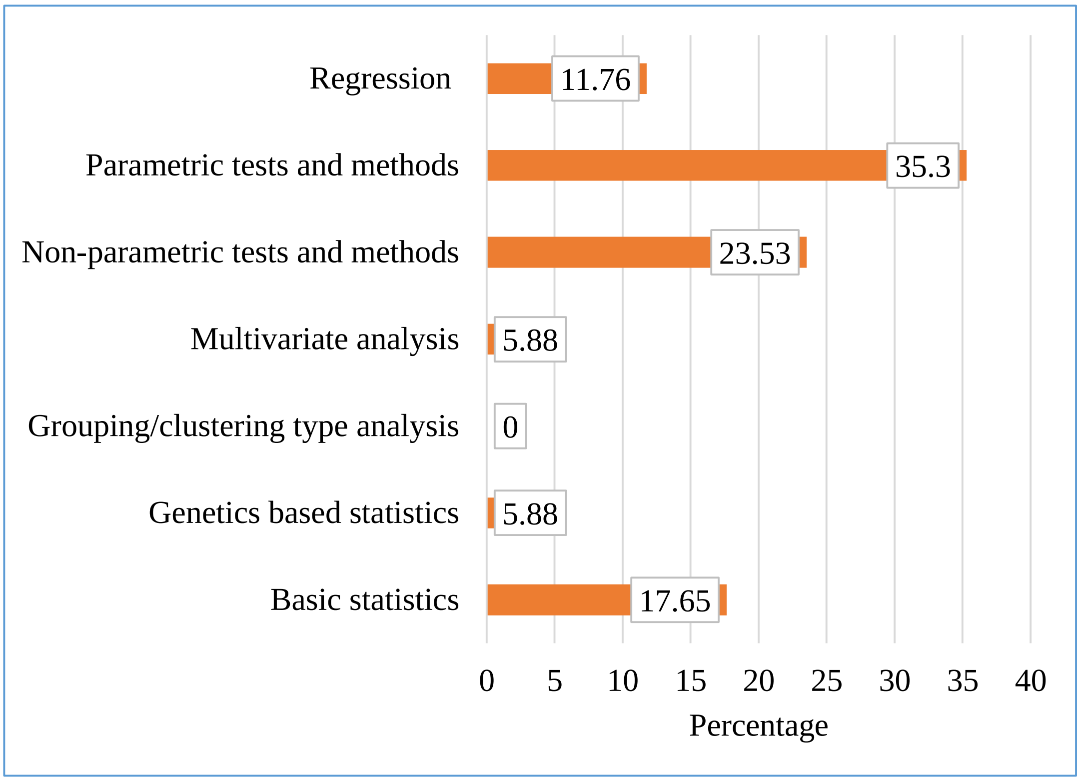


Fig.23: Percentage distribution of statistical methods used in community science

Looking at table 32 and fig. 24 revealed that majority (42.42%) of theses under crop production have sample size ranging from 101-200 followed by 'less than 100' (27.27 %), 201-300 (21.21%), 'greater than 400' (6.06%) and lowest (3.03%) number of theses having range 301-400.

Department wise analysis of results reflected that 57.15 per cent of Agronomy theses belonged to 101-200 sample size range followed by 28.57 per cent (Less than 100 sample size) and 14.28 per cent (201-300 sample size). Likewise, in Soil Science and Agricultural Chemistry department (SSAC) 50.00 per cent of theses studied a sample size range 'less than 100'. This was then followed by 37.50 per cent and 12.50 per cent of theses having sample size ranging from 201-300 and 101-200 respectively. Among Horticulture theses, highest percentage (45.46%) of sample size was found with range from 101-200 followed by 18.18 per cent theses with sample size ranging from 201-300 and 'greater than 400' respectively and 9.09 per cent with sample size ranging from 'less than 100' and 301-400 respectively.

Hence, it can be inferred that under crop production division, only Horticulture theses studied with sample size greater than 300. Regardless of various departments, highest percentage (50.00%) of SSAC theses studied with low sample size (less than 100) and more than half of theses under agronomy used sample size ranging from 101-200.

Table 32: Categorisation of crop production theses based on sample size

Sl.No.	Sample size	Agronomy n=14		SSAC n=8		Horticulture n=11		Total N=33	
		f	%	f	%	f	%	f	%
1	Less than 100	4	28.57	4	50.00	1	9.09	9	27.27
2	101-200	8	57.15	1	12.50	5	45.46	14	42.42
3	201-300	2	14.28	3	37.50	2	18.18	7	21.21
4	301-400	0	00.00	0	00.00	1	9.09	1	3.03
5	Greater than 400	0	00.00	0	00.00	2	18.18	2	6.06
	Total	14	100.00	8	100.00	11	100.00	33	100.00

A cursory look at table 33 showed that under crop protection division, theses with sample size range 101-200 were accounted with 41.66 per cent followed by 25.00 per cent with range 'less than 100' and 16.67 per cent with range 201-300 and 301-400 respectively. It was interesting to note that none of the theses under crop protection showed highest sample size range (Greater than 400).

Table 33: Categorisation of crop protection theses based on sample size

Sl.No.	Sample size	Plant Pathology n=6		Agricultural Entomology n=6		Total N=12	
		f	%	f	%	f	%
1	Less than 100	1	16.67	2	33.33	3	25.00
2	101-200	2	33.33	3	50.00	5	41.66
3	201-300	1	16.67	1	16.67	2	16.67
4	301-400	2	33.33	0	00.00	2	16.67
5	Greater than 400	0	00.00	0	00.00	0	00.00
	Total	6	100.00	6	100.00	12	100.00

With respect to each department results indicated that among Plant Pathology theses majority (33.33%) of research works studied with sample size ranging from 101-200 and 301-400 respectively. This was then followed by 16.67 per cent theses with range 'less than 100' and 201-300 respectively. In Agricultural Entomology department, 50.00 per cent of theses conducted research using sample size ranging from 101-200 followed by 'less than 100' and 201-300 with 33.33 per cent and 16.67 per cent respectively. Hence, it can be inferred that among crop protection theses most commonly preferred sample size range is 101-200 irrespective of departments.

On perusal of data from table 34 and fig. 26 indicated that overall 40.00 per cent of theses fell under sample size category 101-200 followed by 'less than 100' with 35.00 per cent and 201-300 with 10.00 per cent and 15.00 per cent of theses did not specify the sample size taken for the study under crop improvement division.

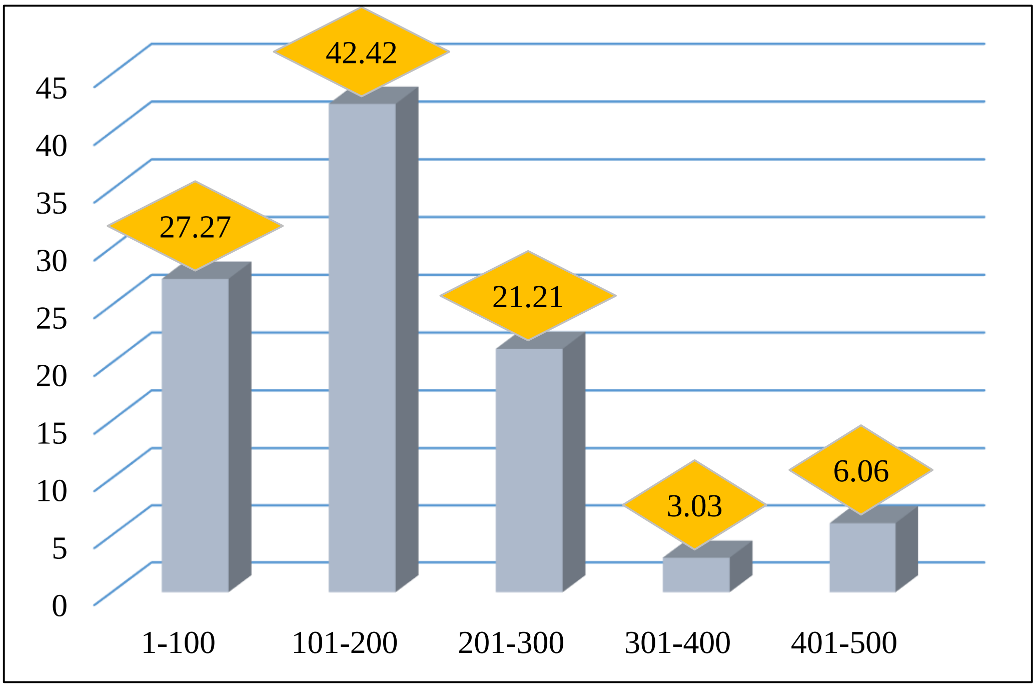


Fig. 24: Percentage distribution of crop production theses based on sample size

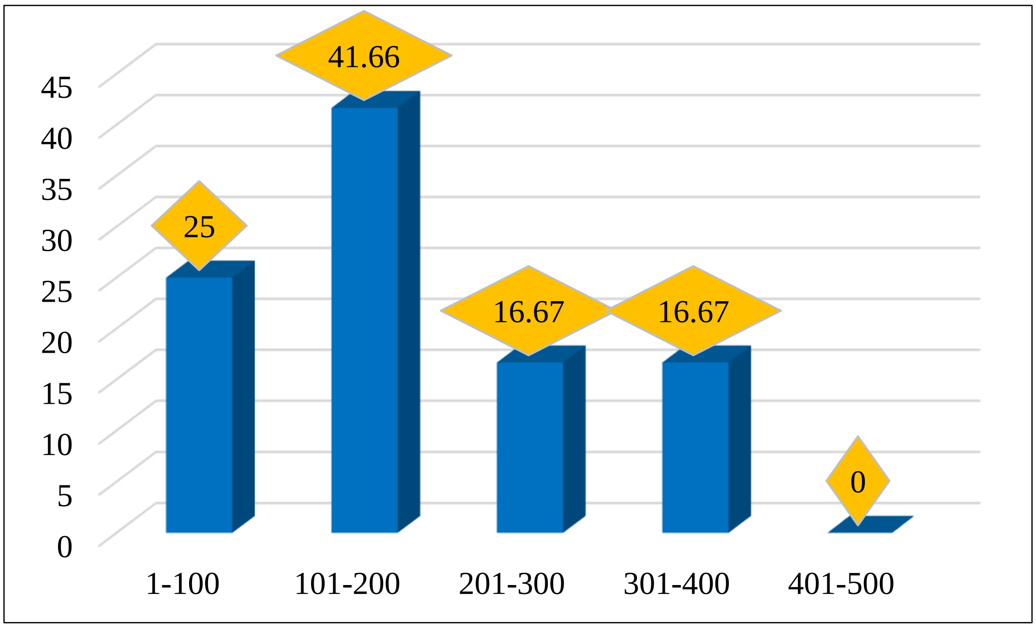


Fig. 25: Percentage distribution of crop protection theses based on sample size

Table 34: Categorisation of crop improvement theses based on sample size

Sl.No.	Sample size	Plant Physiology n=5		PBG n=13		PBT n=2		Total N=20	
		f	%	f	%	f	%	f	%
1	Less than 100	3	60.00	4	30.77	0	00.00	7	35.00
2	101-200	1	20.00	7	53.85	0	00.00	8	40.00
3	201-300	0	00.00	2	15.38	0	00.00	2	10.00
4	301-400	0	09.00	0	00.00	0	00.00	0	00.00
5	Greater than 400	0	00.00	0	00.00	0	00.00	0	00.00
6	Not specified	1	20.00	0	00.00	2	100.00	3	15.00
	Total	5	100.00	13	100.00	2	100.00	20	100.00

A glance at each department revealed that about 60.00 per cent of Plant Physiology theses conducted studies with sample size range ‘less than 100’ followed by 101-200 with 20.00 per cent and remaining 20.00 per cent of theses did not specify the sample size of the study. In Plant Breeding and Genetics department, 53.85 per cent, 30.77 per cent, 15.38 per cent of theses conducted research with sample size ranging from 101-200, ‘less than 100’, 201-300 respectively but the theses under Plant Biotechnology did not specify clearly the sample size of the study which may be due to the unique and independent to that study.

Therefore, it can be concluded that none of the theses under crop improvement studied with sample size greater than 300. and majority of theses had sample size range from 101-200.

Overall analysis of table 35 and fig. 27, revealed that 60.00 per cent of theses under social science division studied with sample size ranging from 201-300 followed by 20.00 per cent with range 101-200 and 301-400 respectively.

It was interesting to observe that none of the theses belonged to range ‘less than 100’ and ‘greater than 400’. About 75.00 per cent and 25.00 per cent of theses in Agricultural Extension department were found to have sample size ranging from 201-300 and 101-200 respectively. In Agricultural Economics, sample size ranged from 301-400.

Table 35: Categorisation of social science theses based on sample size

Sample size	Agricultural economics n=1		Agricultural extension n=4		Total N=5	
	f	%	f	%	f	%
Less than 100	0	00.00	0	00.00	0	00.00
101-200	0	00.00	1	25.00	1	20.00
201-300	0	00.00	3	75.00	3	60.00
301-400	1	100.00	0	00.00	1	20.00
Greater than 400	0	00.00	0	00.00	0	00.00
Total	1	100.00	4	100.00	5	100.00

From table 36 it can be explained that 50.00 per cent of theses from Community Science had sample size range ‘less than 100’ followed by 25.00 per cent with range 101-200 and 301-400 respectively.

Overall analysis of all tables indicated that most of the theses conducted research using sample size ranging from 101-200 followed by ‘less than 100’. It was interesting to note that only in Horticulture theses highest (>400) sample size was used in research.

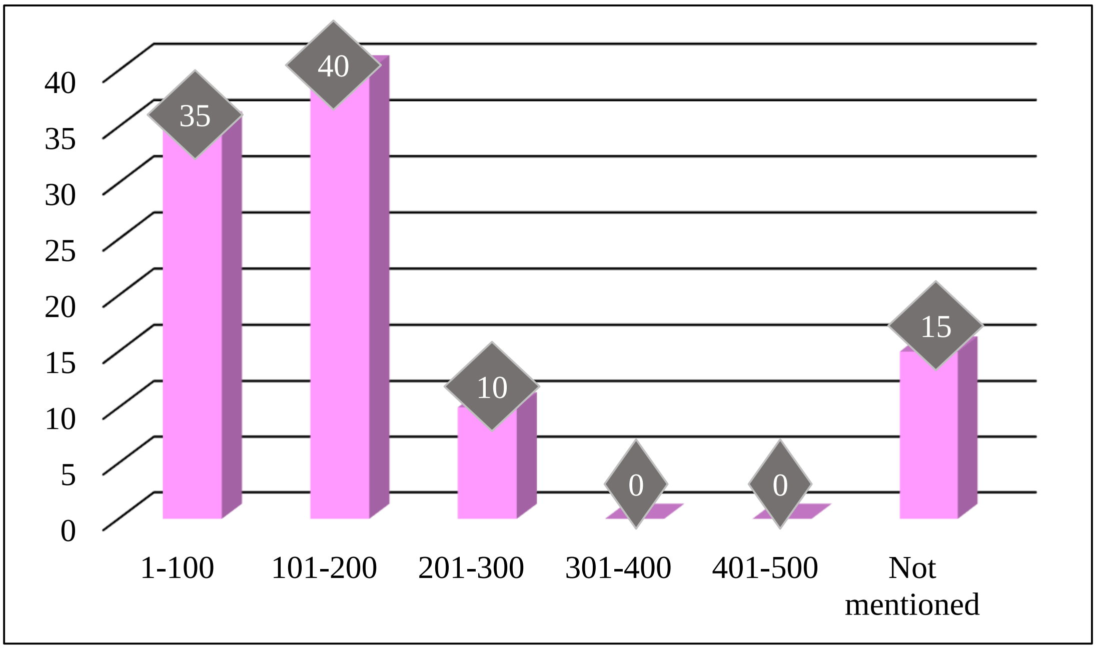


Fig. 26: Percentage distribution of crop improvement theses based on sample size

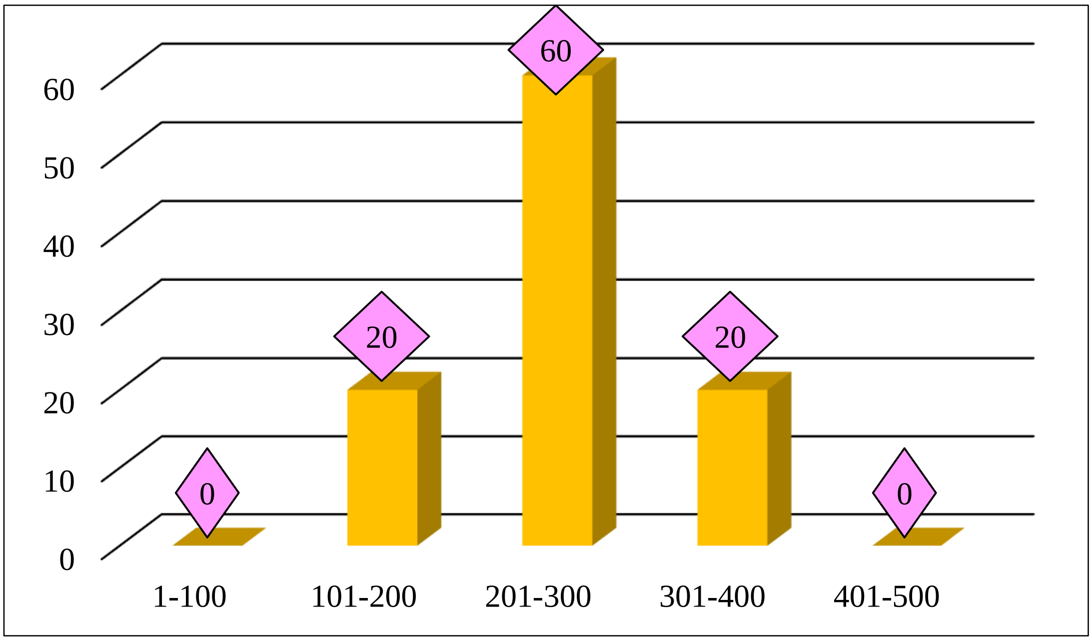


Fig. 27: Percentage distribution of social science theses based on sample size

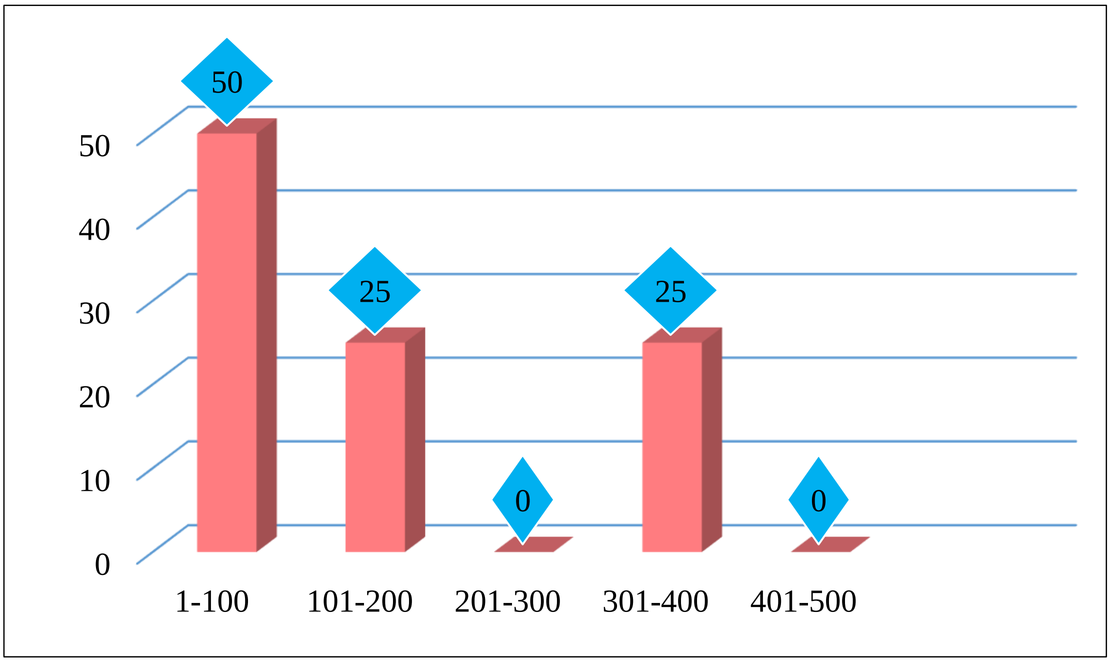


Fig. 28: Percentage distribution of community science theses based on sample size

Table 36: Categorisation of community science theses based on sample size

Sample size	Community science N=4	
	f	%
Less than 100	2	50.00
101-200	1	25.00
201-300	0	00.00
301-400	1	25.00
Greater than 400	0	00.00
Total	4	100.00

The plausible reason could be because of more experiments within the study prompting for different respondents or treatment and replications. The reason for some researches using less sample size (100 or below) may be due to fact that to enable manageable sample size to gather data and master table preparation which also makes analysis easy and more convenient which were in tune with findings of study Sujan (1986).

4.2.9 Types of sampling methods

Sampling methods here in this study was operationalised as selecting a representative group (sample) from the population under the study that was reflected in all the divisions were categorised and demonstrated in table 37.

The cursory study of table 37 and fig. 29, revealed that majority (40.00%) of theses used random sampling followed by 28.00 per cent used purposive sampling and multistage sampling respectively and 4.00 per cent used stratified multistage random sampling irrespective of various divisions.

Table 37: Categorisation of Ph.D. theses based on sampling methods

Sl.No.	Sampling methods	Crop production n=33		Crop protection n=12		Crop improvement n=20		Social science n=5		Community science n=4		Total N=74	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Random sampling	2	33.33	5	55.56	1	33.33	2	40.00	0	00.00	10	40.00
2	Purposive sampling	3	50.00	2	22.22	2	66.67	0	00.00	0	00.00	7	28.00
3	Multistage sampling	1	16.67	2	22.22	0	00.00	3	60.00	1	50.00	7	28.00
4	Stratified multistage random sampling	0	00.00	0	00.00	0	00.00	0	00.00	1	50.00	1	4.00
	Total	6	100.00	9	100.00	3	100.00	5	100.00	2	100.00	25	100.00

On looking at table 37, division wise results indicated that 33.33 per cent of theses used random sampling among crop production theses followed by 50.00 per cent used purposive sampling and 16.67 per cent used multistage sampling. In crop protection division, 55.56 per cent studies used random sampling and 22.22 per cent used purposive sampling and multistage sampling respectively. Likewise, majority (66.67%) of crop improvement studies used purposive sampling and 33.33 per cent used random sampling. Sixty per cent of social science studies used multistage sampling and 40.00 per cent used random sampling. In case of Community Science, 50.00 per cent of studies followed multistage sampling and stratified multistage random sampling respectively.

Therefore, it can be witnessed from above results that from entire research studies an account of twenty-five works conducted survey-type of research, of which random sampling was preferred more in all divisions except Community science. These findings were similar in line with Singh and Gill (1993) and Biswas (2009). This signifies that doctoral research studies are not using higher order sampling techniques

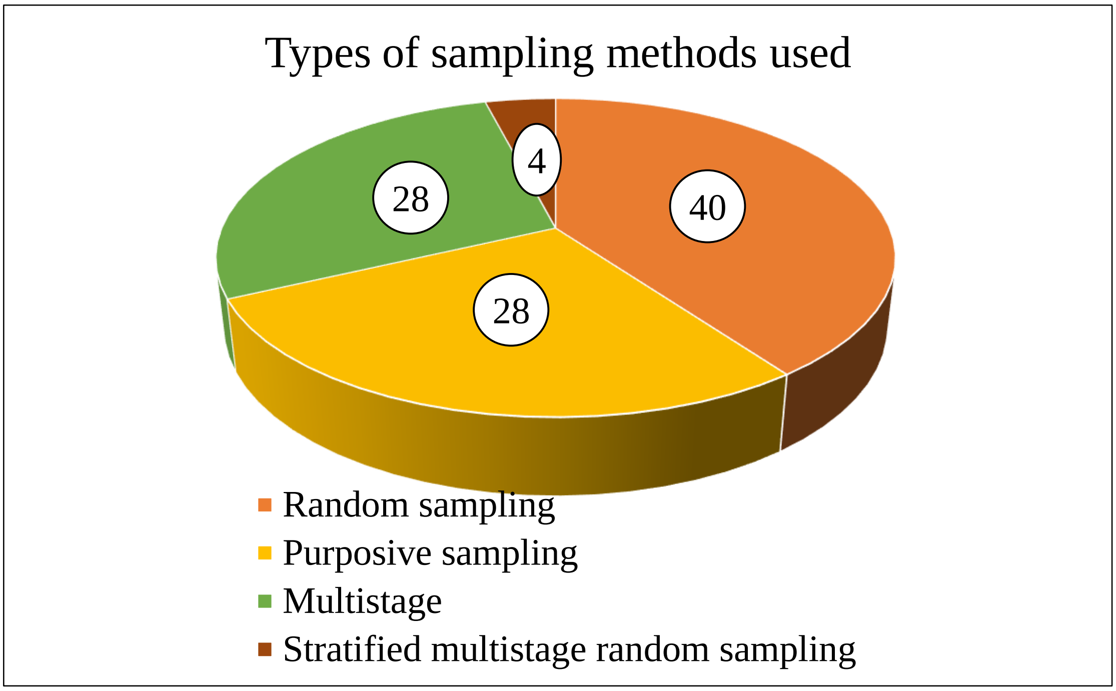


Fig. 29: Percentage distribution of theses based on type of sampling methods

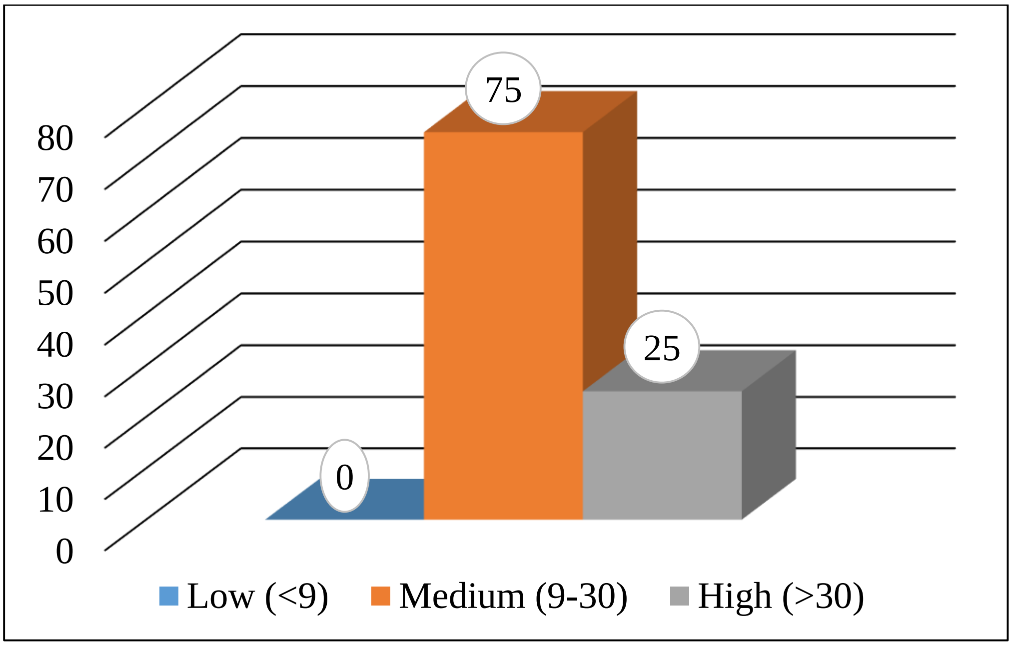


Fig. 30: Percentage distribution of theses in agricultural extension based on number of independent variables

like cluster sampling, stratified sampling *etc.*, that enhance quality of research providing a meaningful interpretation of results instead of using a simple random sampling that facilitates easy identification of respondents. It may also be because the nature of study that requires simple sampling method or researchers wish to submit theses timely without any complicated procedures.

4.2.10 Independent variables

Independent variables are variables that are stable and unaffected by the other variables. The categorisation of theses under social science division based on number of independent variables are presented in table 38.

On examination of results from table 38 revealed that in agricultural economics 14 independent variables were identified. About 75.00 per cent of theses have medium (9-30) number of independent variables in Agricultural Extension followed by 25.00 per cent with high number of independent variables (more than 30). The minimum and maximum number of independent variables was ten and thirty-five respectively.

Table 38: Categorisation of social science theses based on number of independent variables

Agricultural Economics (n=1): 14 independent variables

Agricultural Extension (n=4):

Category	Class limits	f	%
Low (M- SD)	<9	0	0.00
Medium (M±SD)	9-30	3	75.00
High (M+SD)	>30	1	25.00
	Total	4	100.00
Mean= 19.5, SD=10.79, Min.=10 , Max.=35			

4.3 ACADEMIC RESEARCH PRODUCTIVITY OF DOCTORAL DISSERTATIONS IN TERMS OF DIFFERENT ATTRIBUTES

A total of 'five' attributes were divided into two parts as proportion published (4.3.1.1 to 4.3.1.2) and proportion cited (4.3.2.1 to 4.3.2.3). For studying the academic research productivity of doctoral theses in all departments the variables were selected and expounded that are listed as below:

4.3.1 Proportion published

4.3.1.1 Number of publications

4.3.1.2 Publications in peer reviewed journals

4.3.2 Proportion cited

4.3.2.1 Bibliographic form wise distribution of citations

4.3.2.1.1 Based on year

4.3.2.1.2 Based on source

4.3.2.2 Geographic distribution of citations

4.3.2.3 Average number of citations

4.3.1 Proportion Published

Proportion published in this study refer to proportion of papers published by research scholars in scholarly journals that were peer-reviewed during the course of their study. It was represented under following sub-categories:

4.3.1.1 Number of Publications

Number of publications here refers to the total number of publications published by researcher during course of the study. The results showing number of publications with mean as check is presented in table 39.

Table 39: Distribution of doctoral theses based on number of publication

Number of publications	Class limit	Crop production n=33		Crop protection n=12		Crop improvement n=20		Social science n=5		Community science n=4		Total N=74	
		f	%	f	%	f	%	f	%	f	%	f	%
Below mean	<2	9	27.27	6	50.00	10	50.00	3	60.00	1	25.00	29	39.19
Mean	2	14	42.42	3	25.00	8	40.00	1	20.00	1	25.00	27	36.49
Above mean	>2	10	30.30	3	25.00	2	10.00	1	20.00	2	50.00	18	24.32
Total		33	100.00	12	100.00	20	100.00	5	100.00	4	100.00	74	100.00

Results from table 39 and fig. 31 reflected that out of total 74 research studies, 39.19 per cent works published ‘less than two’ publication in the course of their study followed by 36.49 per cent published ‘two’ papers per research work and 24.32 per cent studies published ‘more than two’ papers.

Division wise investigation of results showed that irrespective of division majority of research works had ‘less than two’ papers published. About 42.42 per cent theses had ‘two’ publications in crop production followed by 40.00 per cent from crop improvement, 25.00 per cent from crop protection and Community Science respectively and 20.00 per cent from social science division. In case of crop production division, 30.30 per cent researches had ‘more than two’ papers published followed by 27.27 per cent researches published ‘less than two’ research papers. Among crop protection research studies, 50.00 per cent of theses had ‘less than two’ publications and 25.00 per cent of research studies had ‘more than two’ papers published. Under crop improvement, majority (50.00%) of theses had ‘less than two’ papers and 10.00 per cent had ‘more than two’ papers published. Likewise, 60.00 per cent of research works from social science division published ‘less than two’ papers and 10.00 per cent published ‘more than two’ papers. As observed from Community Science, 50.00 per cent of research works published ‘more than two’ papers and 25.00 per cent published ‘less than two’ papers.

Hence, from this cursory investigation it was revealed that more publications from doctoral research were reported to be ‘less than two’ from crop protection, crop improvement and social science division whereas under crop production division at least two publications were published from majority (42.42%) of research works and community science theses published more than two publications at least. On an average, only two publications were published during doctoral research as per university guidelines. The probable reason for publishing less number of articles could be the protracted publication process with rigorous peer-reviewing which is time consuming that makes students exhausted and less interested in publishing more articles. Also, after getting awarded with doctorate degree and assuming a permanent job that is totally disconnected with the area of research, the researcher may lose interest in further publication. In order to improve research output, students should be trained academically by encouraging them to write review articles related to their study or in similar interest areas during the course of their study. This can put less pressure on PhD students during publication process. This will help to encourage the students for publishing good research articles in journals of repute and in turn will help to improve academic research productivity of university significantly.

4.3.1.2 Publication in peer reviewed journals

Publications in peer reviewed journals in this study refer to number of articles published in refereed journals that were listed in National Academy of Agricultural Sciences (NAAS) rated journals, University Grants Commission (UGC)- Consortium for Academic Research and Ethics (CARE) list or other similar measurements. The results reflecting this study are illustrated in table 40.

A cursory look at table 40 and fig. 32 indicates, out of 165 publications majority (82.42%) of publications were published in NAAS rated journals followed by 12.12 per cent in Google Scholar indexed journals, 2.42 per cent in Copernicus index and other measurements respectively, 1.21 per cent in UGC CARE list and 0.61 per cent publications from Scopus index.

Table 40: Categorisation of publications in peer reviewed journals among doctoral theses

Category	Crop production n=88		Crop protection n=24		Crop improvement n=32		Social science n=10		Community science n=12		Total N=165	
	f	%	f	%	f	%	f	%	f	%	f	%
NAAS	74	84.1	21	87.5	28	87.50	7	70.00	6	50.00	136	82.42
UGC care list	0	00.00	0	00.00	0	00.00	1	10.00	1	8.33	2	1.21
Copernicus index	2	2.27	0	00.00	1	3.12	0	00.00	1	8.33	4	2.42
Scopus index	0	00.00	0	00.00	0	00.00	0	00.00	1	8.33	1	0.61
Google scholar	11	12.50	3	12.50	2	6.25	2	20.00	2	16.67	20	12.12
Others	2	2.27	0	00.00	1	3.13	0	00.00	1	8.33	4	2.42
Total	88	100.00	24	100.00	32	100.00	10	100.00	12	100.00	165	100.00

*In case a journal included both in NAAS rated list and UGC care list is mentioned under NAAS rated list

Nevertheless, by considering division wise, 84.10 per cent publications were published in NAAS rated journals followed by 12.50 per cent in Google Scholar, 2.27 per cent in Copernicus index and other indexed journals respectively among crop production division publications.

Crop protection publications were published in NAAS rated journals in majority (87.5%) and remaining 12.50 per cent publications in Google Scholar indexed journals. In case of crop improvement theses, publications under NAAS rated journals accounted about 87.50 per cent followed by 6.25 per cent, 3.13 per cent, 3.12 per cent theses papers were published in journals that are indexed in Google Scholar, other index lists and Copernicus index respectively. In social science division, 70.00 per cent papers were published in NAAS rated journals followed by 20.00 per cent in Google Scholar and 10.00 per cent in UGC CARE listed journals. In Community Science, 50.00 per cent were published in listed in NAAS rated journals followed by 16.67 per cent in Google Scholar, 8.33 per cent in UGC-CARE list, Copernicus index, Scopus index and other measurements respectively.

Hence, it can be inferred from the analysis that most of the articles were published in NAAS rated journals followed by Google Scholar indexed journals. Even though the papers were published under NAAS rated journals it is desirable to have articles in journals that has high NAAS rating (6 + impact factor). Publications in journals that belong to international indices like Copernicus index or Scopus index also increase the quality of paper and thereby enhance academic research productivity. But the journals that have high NAAS rating has arduous peer review process and also require high publication costs which may also be the reason for students not selecting such papers for publications. This is also the same case for internationally indexed journals. In such cases, if more funds are kept as publication costs for students in addition to research grant the students will be in a position to publish good quality papers in high rated journals. Also, the students should be trained to search for high rated unpaid journals for publication.

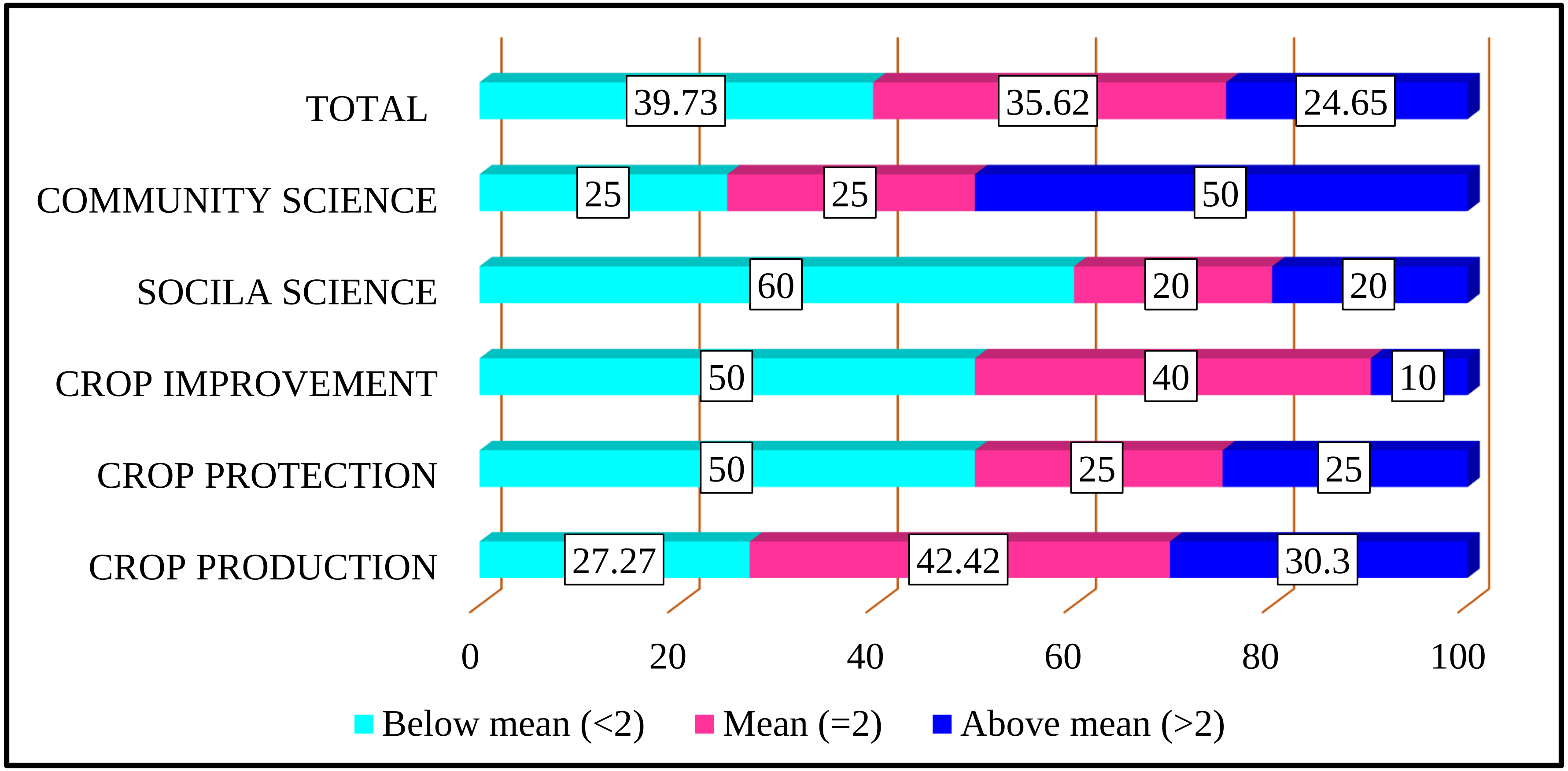


Fig. 31: Percentage distribution based on number of publications under each division

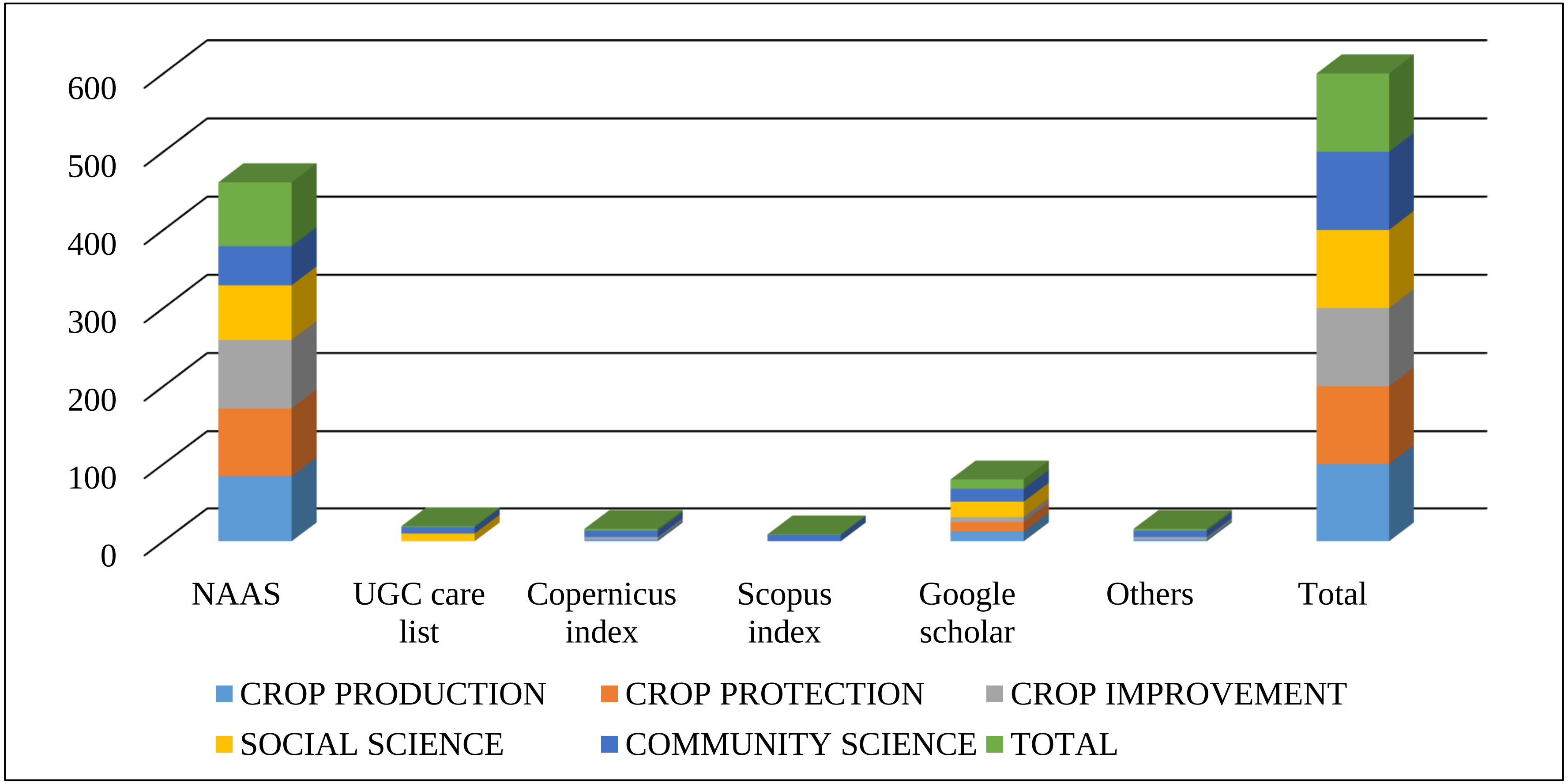


Fig. 32: Percentage distribution of publications in peer reviewed journals

3.2 Proportion Cited

4.3.2.1 Bibliographic form Wise Distribution of Citations

Bibliographic form wise distribution of citations in this study refer to distribution of citations cited in text and their bibliographic format indicated at the end of thesis. This was studied under following sub-headings:

4.3.2.1.1 Based on year of citations

4.3.2.1.2 Based on source of citations

4.3.2.1.1 Based on Year of Citations

Citations based on year in this study refer to distribution of citations in theses based on the year in which publication was published. The results are illustrated in table 41.

Overall data in table 41 and fig. 33 reflected that maximum number of citations *i. e.* 25,523 (84.05 %) were from period after 1990 followed by period from 1961-1990 for 4088 (13.46 %) citations, 619 (2.04 %) citations for period 1931-1960, 112 (0.37 %) citations for period 1900-1930 and period before 1900 accounts for 24 (0.08 %) citations.

By looking at division wise results, irrespective of divisions majority (94.64%) of citations were from period after 1990 in social science followed by 92.46 per cent in Community Science, 83.14 per cent in crop improvement, 82.50 per cent in crop production and 82.40 per cent in crop protection division. In crop production division, 14.47 per cent citations were from 1961-1990, 2.79 per cent during 1931-1960, 0.20 per cent during 1900-1930 and 0.04 per cent citations before 1900. In crop protection division, citations during 1961-1990 accounted about 15.53 per cent followed by 0.87 per cent during 1931-1960 and 1900-1930 respectively and 0.33 per cent before 1900. In crop improvement, 14.11 per cent of citations were from period 1961-1990 followed by 2.20 per cent from 1931-1960, 0.50 per cent from 1900-1930 and 0.05 per cent before 1900. Likewise, in social science 4.86 per cent citations were cited from period 1961-1990 followed by 0.36 per cent during 1931-1960 and 0.14 per cent citations during 1901-1930. As observed under Community Science division, 6.95 per cent.

Table 41: Distribution of citations based on year

Category	Crop production n=33		Crop protection n=12		Crop improvement n=20		Social Sciences n=5		Community science n=4		Total N=74	
	f	%	f	%	f	%	f	%	f	%	f	%
Below 1900	5	0.04	15	0.33	4	0.05	0	00.00	0	00.00	24	0.08
1900-30	26	0.20	40	0.87	44	0.50	2	0.14	0	00.00	112	0.37
1931-60	366	2.79	40	0.87	193	2.20	5	0.36	15	0.59	619	2.04
1961-90	1895	14.47	714	15.53	1236	14.11	67	4.86	176	6.95	4088	13.46
Above 1990	10804	82.50	3789	82.40	7282	83.14	1305	94.64	2343	92.46	25523	84.05
Total	13096	100.00	4598	100.00	8759	100.00	1379	100.00	2534	100.00	30366	100.00

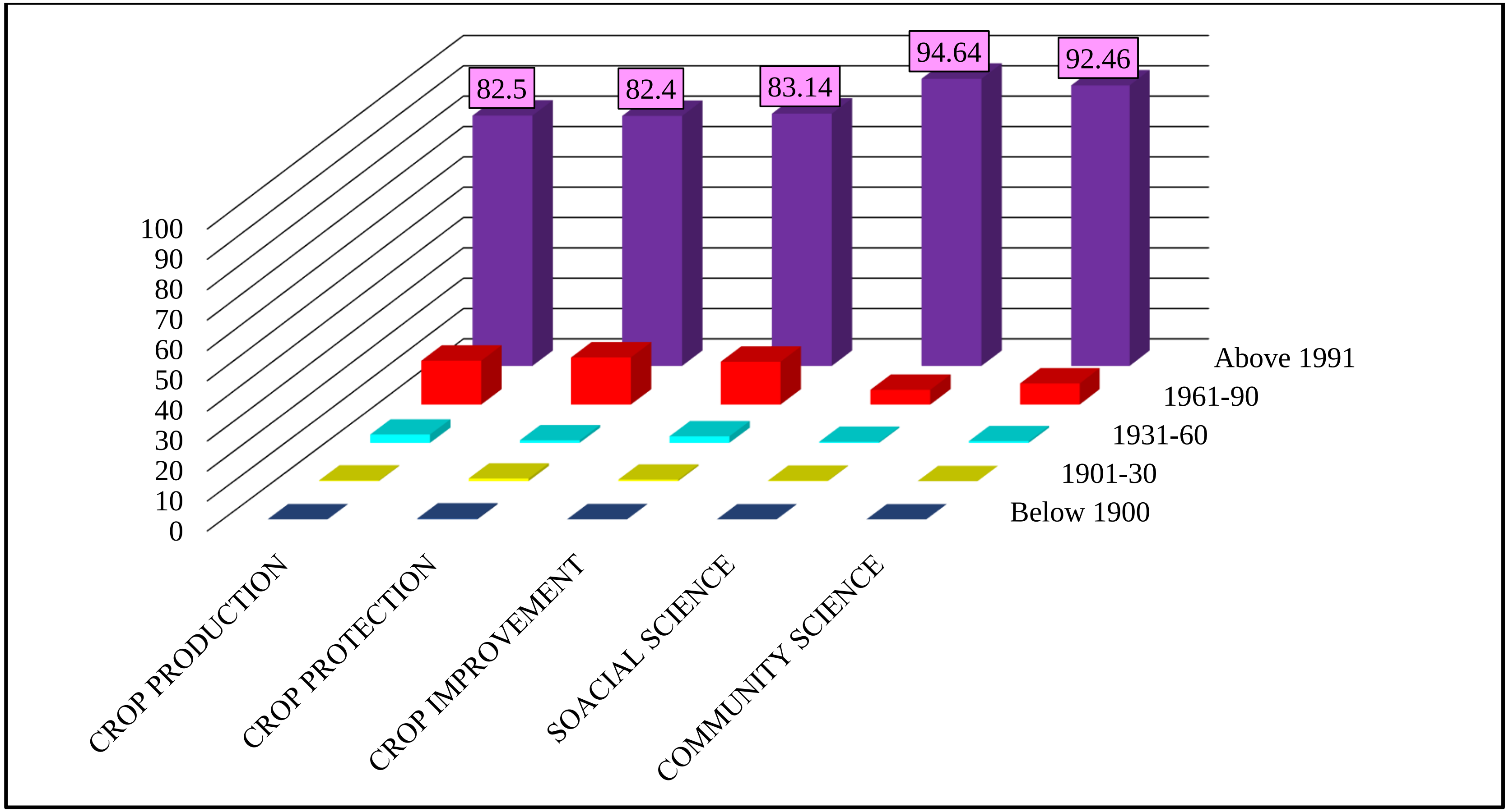


Fig. 33 Percentage distribution of citations based on year

citations were from during 1961-1990 then followed by 0.59 per cent citations from 1931-1960.

It was interesting to note that among Community Science theses there were no citations cited before 1900 and during 1900-1930. As in similar case no publications were cited from before 1900 under social science division. Therefore, it can be concluded that highest number of citations were published after 1990 as data for review chosen for theses submitted during 2015-2019. This data indicated that researchers referred latest literature. These findings were in similar line with Hiremath and Sangen (1988) and Kittur (2017).

However, researchers have a misconception that more number of citations will increase the quality of research which is not the case often. Many agree with the view that giving importance to quality over quantity of research which can be achieved by incorporating literature based on analytical and / or systemic process of research (Dkhar, 2019).

4.3.2.1.2 Based on Source of Citation

Source of citations in this study refer to source or type of publication citations approached by researcher in theses during research work. The results reflected in table 42, 43, 44, 45 and 46 presented the following findings:

A total of 35 types of publications were cited in the theses submitted during 2015 to 2019. Of them under each division 'ten' most cited sources of publications were presented in table 42, 43, 44, 45 and 46 and complete tables were presented under appendix IV.

In crop production division as seen in table 42 and fig. 34, most cited source were journals (73.28 %) followed by books, Masters of Science (M.Sc.) theses, Doctor of Philosophy (Ph.D.) theses, proceedings, compiled books, e-resources, government publications, technical bulletin or series and abstracts.

Table 42: Distribution of crop production theses based on source of citations

Sl.No.	Source	Agronomy n=14		SSAC n=8		Horticulture n=11		Total N=33	
		f	%	f	%	f	%	f	%
1	Journals	3442	70.36	2288	72.82	3864	76.38	9594	73.28
2	Books	456	9.32	273	8.7	285	5.63	1014	7.75
3	Proceedings	180	3.68	104	3.31	82	1.62	366	2.79
4	M.Sc. Theses	227	4.64	166	5.28	393	7.77	786	6.00
5	Ph.D. Theses	120	2.45	46	1.46	208	4.11	374	2.86
6	E resources	148	3.03	27	0.86	32	0.63	207	1.58
7	Compiled books	108	2.21	110	3.50	62	1.23	280	2.14
8	Technical bulletin/series	30	0.61	4	0.13	27	0.53	61	0.47
9	Abstract	26	0.53	9	0.29	24	0.47	59	0.45
10	Government publications	27	0.55	27	0.86	18	0.35	72	0.54

Department wise analysis indicated that in Agronomy department, journals were cited in majority (70.36 %) followed by books and M.Sc. theses with 9.32 per cent and 4.64 per cent respectively, proceedings (3.68 %), e- resources (3.03 %), Ph.D. theses (2.45 %), compiled books (2.21%), technical bulletins or series (0.61 %), government publications (0.55 %) and abstract with 0.53 per cent citations. In Soil Science and Agricultural Chemistry department theses, journals were cited most with 72.82 per cent then followed by citations from books (8.70 %), M.Sc. theses (5.28 %), compiled books (3.50 %), proceedings (3.31%), Ph.D. theses (1.46 %), e-resources and government publications with 0.86 per cent respectively, abstract (0.29%) and technical bulletin or series (0.13 %). Meanwhile, in Horticulture department 76.38 per cent sources cited were from journals followed by M.Sc. theses with 7.77 per cent, books with 5.63 per cent, Ph.D. theses with 4.11 per cent, proceedings with 1.62 per cent, compiled books with 1.23 per cent, e-resources with 0.63 per cent, technical bulletin or series, abstract and government publications with 0.53 per cent, 0.47 per cent and 0.35 per cent respectively.

Therefore, it can be concluded that more than seventy per cent of citations in all departments under crop production division belonged from journals and remaining all sources accounted for less than 10 per cent.

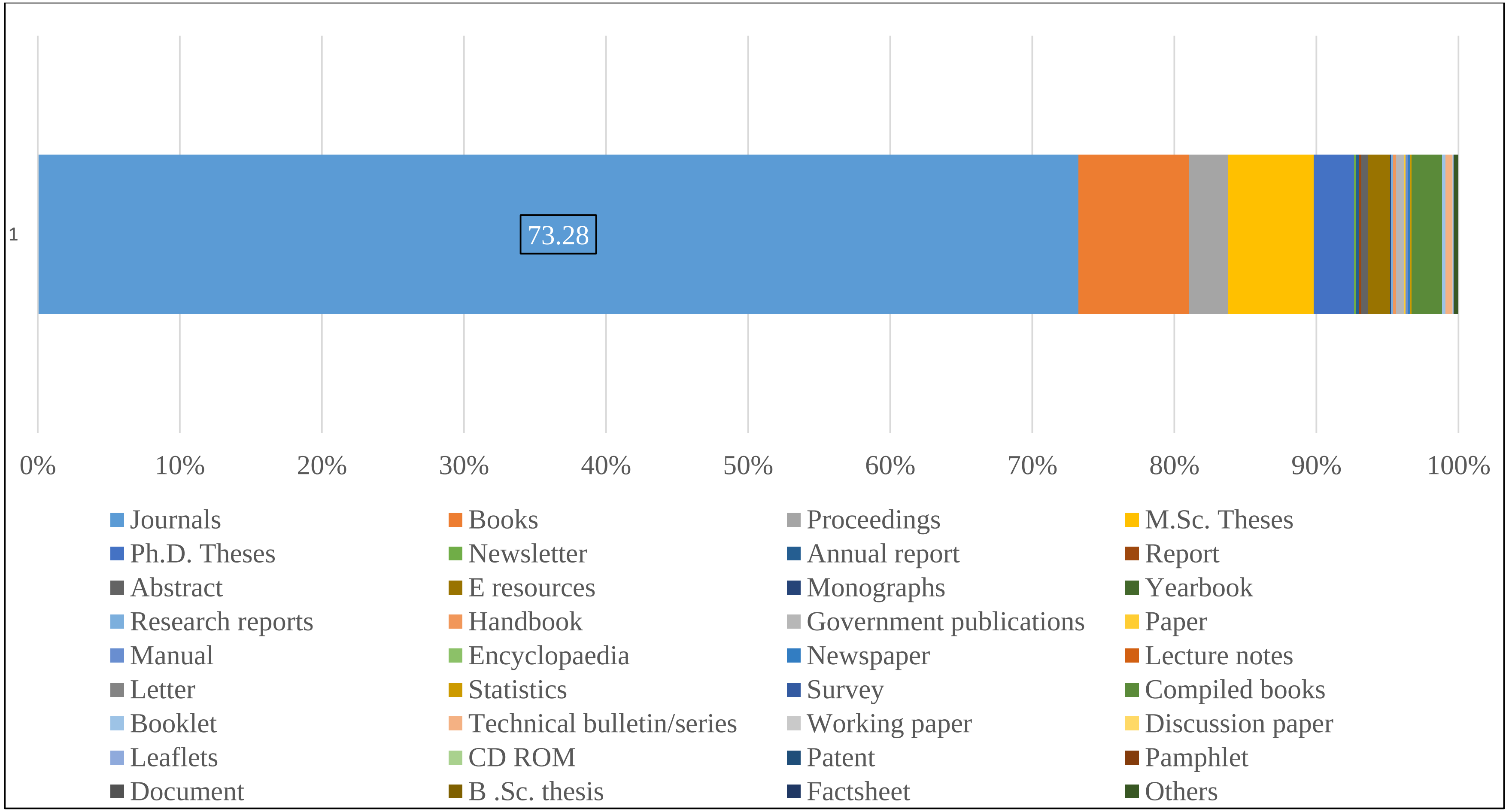


Fig. 34 Percentage distribution of crop production theses based on source of citations

Among the various sources identified under crop protection theses from table 43 and fig. 35, journals were cited most with 77.43 per cent followed by books (5.92%), M.Sc. theses (3.88%), proceedings (2.65%), Ph.D. theses (2.13%), e-resources (1.87%), compiled books (1.79%), technical bulletin or series (0.67%), annual report (0.58%) and abstract (0.52%).

Table 43: Distribution of crop protection theses based on source of citations

Sl.No.	Source	Plant pathology n=6		Agricultural entomology n=6		Total N=12	
		f	%	f	%	f	%
1	Journals	2080	75.61	1481	80.14	3561	77.43
2	Books	200	7.27	72	3.89	272	5.92
3	Proceedings	89	3.24	33	1.78	122	2.65
4	M.Sc. Theses	120	4.37	58	3.14	178	3.88
5	Ph.D. Theses	32	1.16	66	3.57	98	2.13
6	E resources	69	2.51	17	0.92	86	1.87
7	Technical bulletin/series	17	0.62	14	0.76	31	0.67
8	Compiled books	49	1.78	33	1.79	82	1.79
9	Annual report	11	0.31	16	0.87	27	0.58
10	Abstract	13	0.48	11	0.6	24	0.52

Looking into each department, it was revealed that in Plant Pathology, majority (75.61%) of citations were from journals. This was followed with 7.27 per cent citations from books, 4.37 per cent from M.Sc. theses, 3.24 per cent from proceedings, 2.51 per cent from e-resources, 1.78 per cent from compiled books, 1.16 per cent from Ph.D. theses, technical bulletin or series, abstract and annual report with 0.62 per cent, 0.48 per cent and 0.31 per cent respectively. Likewise, in Agricultural Entomology department, 80.14 per cent citations were from journals followed by books (3.89%), Ph.D. theses (3.57%), M.Sc. theses (3.14%), compiled books (1.79%), proceedings

(1.78%), e-resources (0.92%), annual report (0.87%), technical bulletin or series (0.76%), and abstract with 0.60 per cent citations.

Hence, regardless of departments it can be inferred that more than seventy-five per cent of citations were cited from journals, followed by books with less than ten per cent and rest of all sources with less than five per cent.

On scrutinizing table 44 and fig. 36 of crop improvement division, it can be observed that journals were cited in highest number followed by books, M.Sc. theses, compiled books, proceedings, Ph.D. theses, e-resources, government publications, abstracts and newsletter.

Table 44: Distribution of crop improvement theses based on source of citations

Sl.No.	Source	Plant Physiology n=5		PBG n=13		PBT n=2		Total N=20	
		f	%	f	%	f	%	f	%
1	Journals	1724	85.43	4870	84.31	877	90.97	7471	85.30
2	Books	68	3.37	231	3.99	30	3.11	329	3.77
3	Proceedings	60	2.97	94	1.62	7	0.73	161	1.84
4	M.Sc. Theses	25	1.24	219	3.79	12	1.24	256	2.92
5	Ph.D. Theses	9	0.44	98	1.70	2	0.21	109	1.24
6	Newsletter	0	0.00	14	0.24	0	0	14	0.16
7	Abstract	2	0.10	12	0.21	14	1.45	28	0.32
8	E resources	14	0.69	34	0.59	1	0.10	49	0.56
9	Government publications	13	0.64	22	0.38	0	0.00	35	0.40
10	Compiled books	66	3.27	112	1.94	7	0.73	185	2.11

Department wise, it can be seen that 85.43 per cent of citations under Plant Physiology department were from journals followed by books (3.37%), compiled books (3.27%), proceedings (2.97%), M.Sc. theses (1.24%), e-resources (0.69%), government publications (0.64%), abstracts (0.10%) and no citations from newsletter. In Plant Breeding and Genetics department, journals accounted for 84.31 per cent citations. This was then trailed by books (3.99%), M.Sc. theses (3.79%), compiled books (1.94%), Ph.D. theses (1.70%), proceedings (1.62%), e-resources (0.59%), government

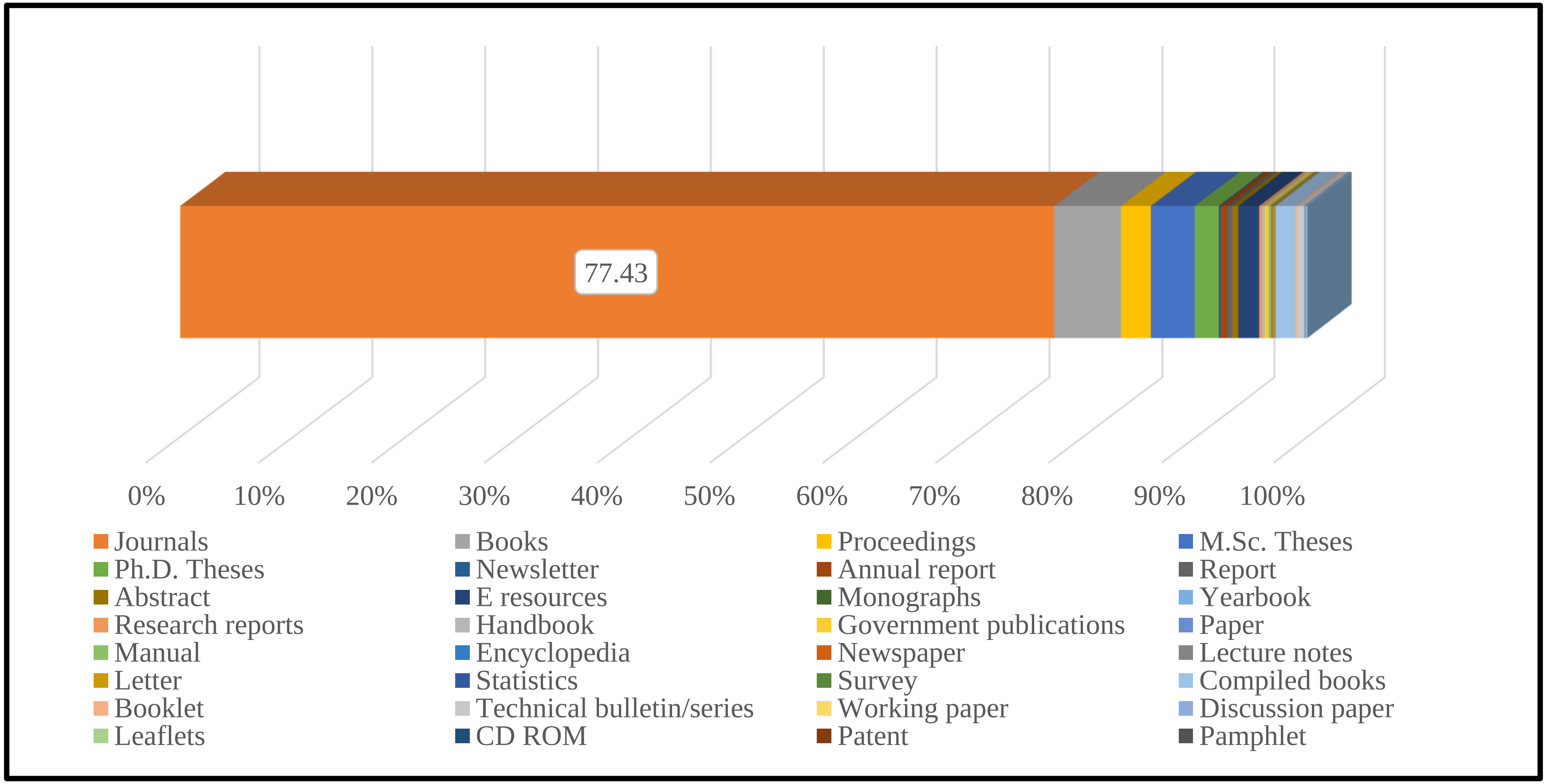


Fig. 35: Percentage distribution of crop protection theses based on source of citations

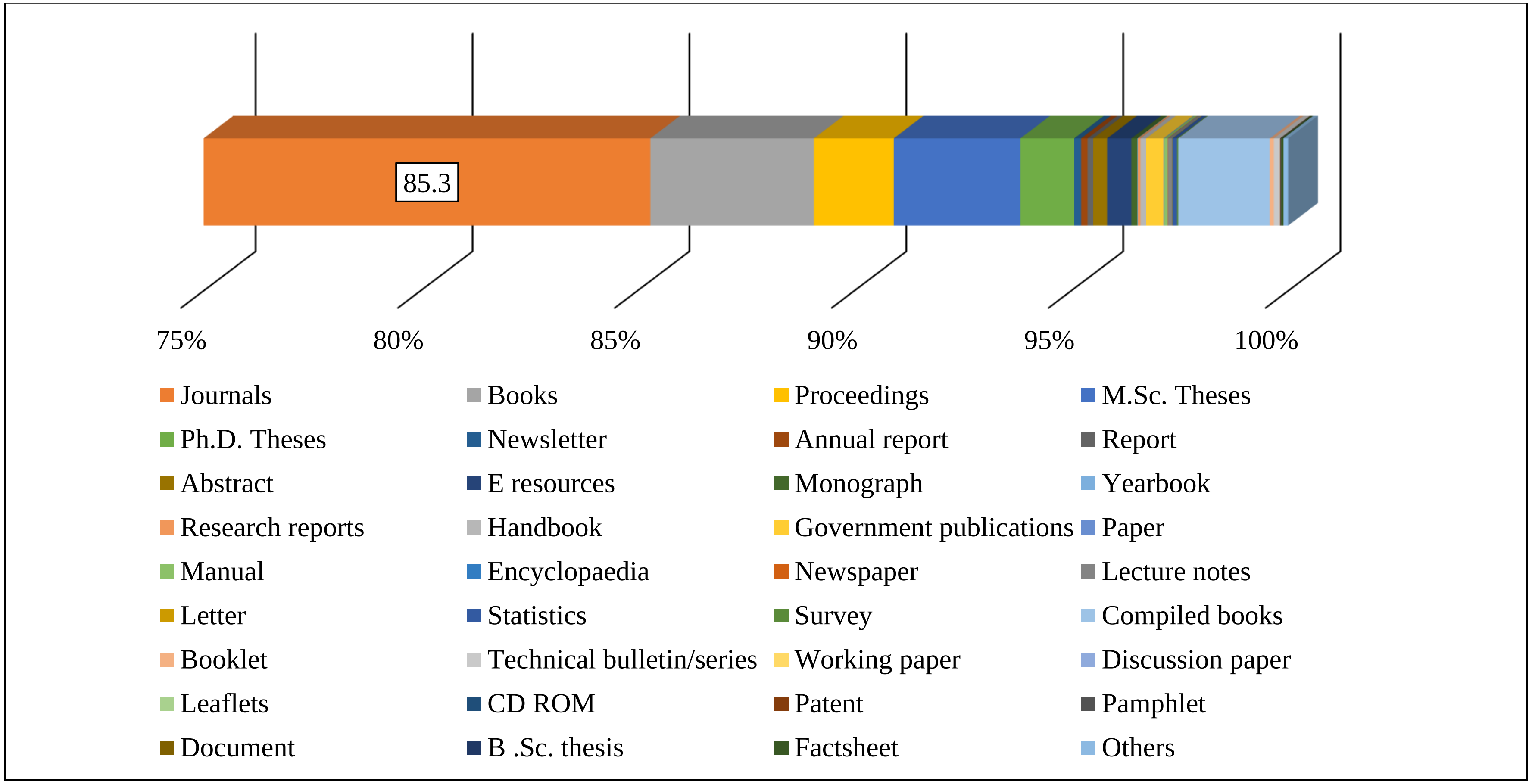


Fig. 36: Percentage distribution of crop improvement theses based on source of citations

publications (0.38%), newsletter (0.24%) and abstracts (0.21%). Likewise, in department of Plant Biotechnology theses about 90.97% of citations were from journals followed by books (3.11%), abstracts (1.45%), M.Sc. theses (1.24%), compiled books and proceedings with 0.73 per cent respectively, Ph.D. theses (0.21%), e-resources (0.10%) and no citations from newsletter and government publications.

It can be inferred that more than eighty-four per cent of citations from each department theses were from journals and the remaining percentage of citations accounted less than five per cent.

Table 45: Distribution of social science theses based on source of citations

Sl.No.	Source	Agricultural economics n=1		Agricultural extension n=4		Total N=5	
		f	%	f	%	f	%
1	Journals	106	41.73	507	52.38	613	50.16
2	Books	27	10.63	82	8.47	109	8.92
3	Proceedings	9	3.54	24	2.48	33	2.70
4	M.Sc. Theses	30	11.81	65	6.71	95	7.77
5	Ph.D. Theses	10	3.94	77	7.96	87	7.12
6	E resources	16	6.30	83	8.57	99	8.10
7	Government publications	8	3.15	27	2.79	35	2.86
8	Compiled books	4	1.57	21	2.17	25	2.05
9	Working paper	4	1.58	14	1.44	18	1.47
10	Technical bulletin/series	13	5.12	2	0.21	15	1.23

From table 45 and fig. 37, it was observed that journals were the most cited source of publications in social science department with 50.16 per cent citations. This was then followed by books, e-resources, M.Sc. theses, Ph.D. theses, government publications, proceedings, compiled books, working paper and technical bulletin or series.

Results analysed based on each department indicated that among Agricultural Economics theses, 41.73 per cent of citations were from journals trailed by M.Sc. theses with 11.81 per cent, books with 10.63 per cent, e-resources with 6.30 per cent, technical bulletin or series with 5.12 per cent, Ph.D. theses with 3.94 per cent, proceedings with 3.54 per cent, government publications with 1.58 per cent and compiled books with

1.57 per cent citations. In Agricultural Extension theses, majority (52.38%) of citations were from journals followed by e-resources with 8.57 per cent, books with 8.47 per cent, Ph.D. theses with 7.96 per cent, M.Sc. theses with 6.71 per cent, government publications with 2.79 per cent, proceedings with 2.48 per cent, compiled books with 2.17 per cent, working paper with 1.47 per cent and technical bulletin or series with 0.21 per cent.

Hence, from this analysis it can be concluded that in each department more than forty per cent of citations were from journals and remaining citations belong to various other sources as mentioned in appendix IV.

From table 46 and fig.38, it can be observed that majority (72.85%) of citations under Community Science were from journals followed by books with 9.40 per cent, M.Sc. theses with 4.93 per cent, Ph.D. theses with 3.08 per cent, government publications with 1.78 per cent, report with 1.14 per cent, other publications with 0.79 per cent, proceedings and working paper with 0.55 per cent respectively and remaining all are presented in appendix IV.

Table 46: Distribution of community science theses based on source of citations

Sl.No.	Source	Community science N=4	
		f	%
1	Journals	1846	72.85
2	Books	238	9.40
3	Proceedings	14	0.55
4	M.Sc. Theses	125	4.93
5	Ph.D. Theses	78	3.08
6	Report	29	1.14
7	E resources	27	1.07
8	Government publications	45	1.78
9	Working paper	14	0.55
10	Others	20	0.79

From this overall cursory investigation, it can be concluded that more than 70.00 per cent of citations were taken from journals alone, which was on par with crop production, crop protection, crop improvement and Community Science theses except

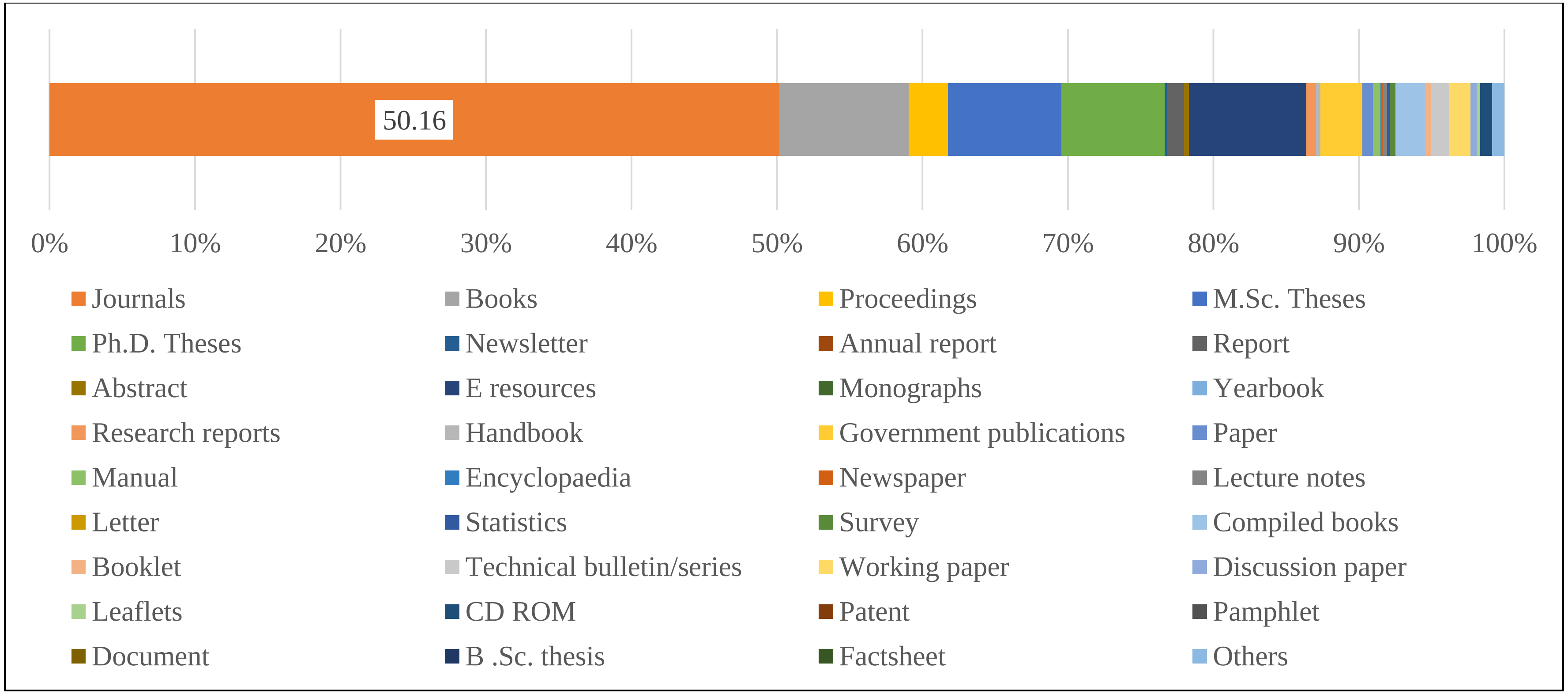


Fig. 37: Percentage distribution of social science theses based on source of citations

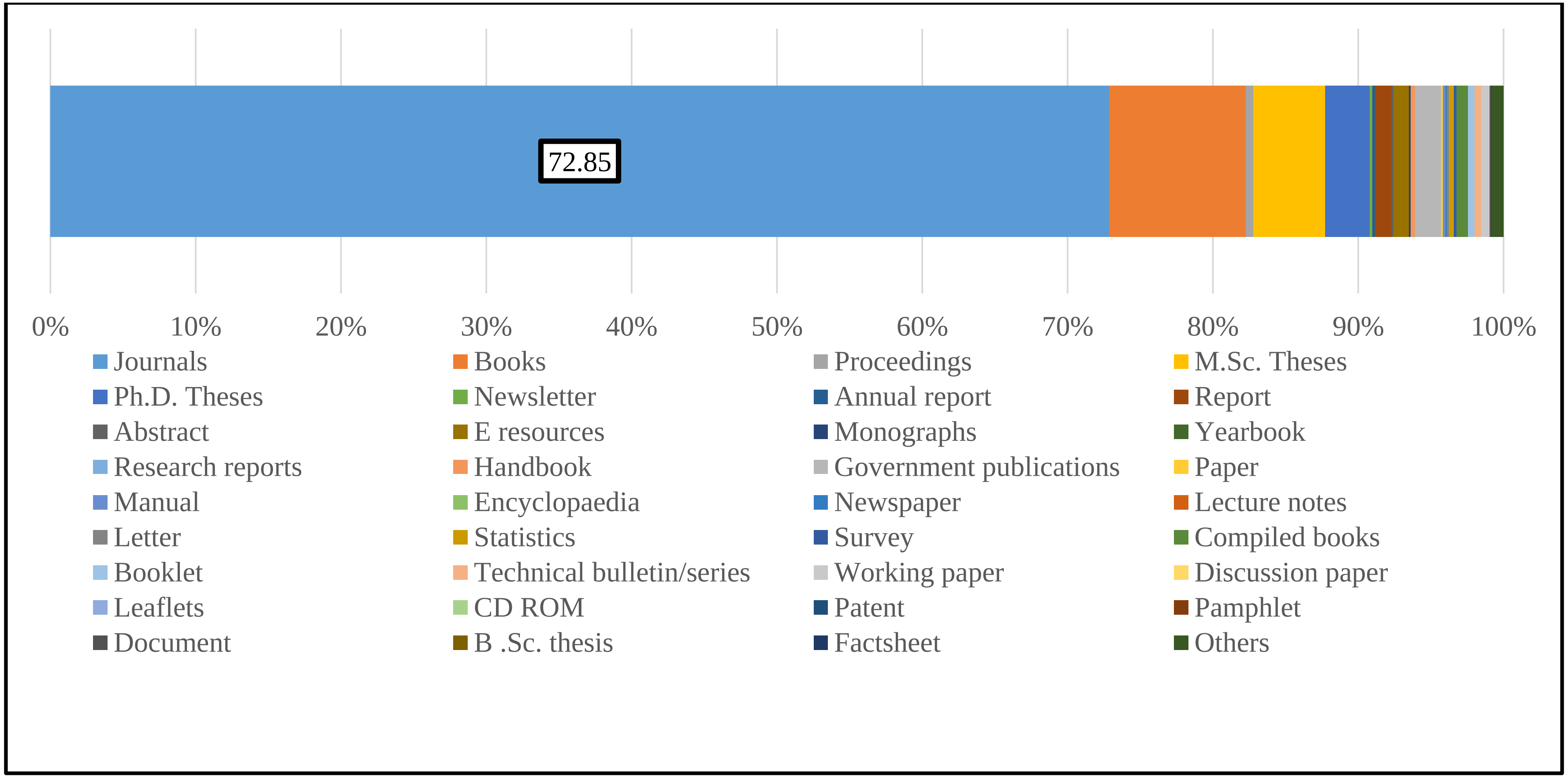


Fig. 38: Percentage distribution of community science theses based on source of citations

in social science theses with 50.16 per cent from journals. The result aligns with study conducted by Yeap and Kaur (2008), Banateppanvar *et al.* (2013) and Kittur (2017).

Hence, it can be concluded that journals were the most preferred form of publication researcher searches for information. It can be because journals give authentic information and promising results where the time barrier of their citations are less compared to other sources which shows the researchers importance in communicating scholarly literature and also their dependency for their research work. Though books, theses, proceedings were cited less than 10 per cent it shows their relative importance as scholars refer literature depending upon their research work requirement. It was interesting to note that researchers were depending on various reliable sources which emphasises their results of research work as seen in appendix IV.

4.3.2.2 Geographic distribution of citations

Geographic distribution of citations in this study refer to citations from which country were referred more by researchers. The results regarding this distribution are presented based on average number of citations under national and international categories in table 47.

It was clear from examining the table that overall average number of citations belonging to national publications was 157 with range 31 to 539 whereas 253 from international publications ranging from 63-622.

Looking at each division from table 47 and fig. 39, it can be understood that in crop production theses average number of citations under national publications was 129 whereas 220 from international publications in Agronomy department. Furthermore, among Soil Science and Agricultural Chemistry theses 149 and 244 was the average number of citations under national and international publications respectively whereas 187 and 272 from national and international publications respectively in Horticulture department.

Under crop protection division, average number of citations from national and international publications was 157 and 302 respectively in Plant Pathology theses and in Agricultural Entomology theses 113 and 195 citations was the average number of national and international publications respectively. In crop improvement division, average number of citations in Plant Physiology theses was 128 and 275 from national and international publications respectively. Meanwhile, in Plant Breeding and Genetics department theses average number of citations was 195 and 250 whereas 129 and 353 in Plant Biotechnology department theses from national and international publications respectively.

Table 47: Distribution of theses based on geographic distribution of citations

Division	Department	National	International
		Average number	Average number
Crop production n=33	Agronomy n=14	129	220
	SSAC n=8	149	244
	Horticulture n=11	187	272
Crop production n=12	Plant pathology n=6	157	302
	Agricultural entomology n=6	113	195
Crop improvement n=20	Plant physiology n=5	128	275
	PBG n=13	195	250
	PBT n=2	129	353
Social science n=5	Agricultural economics n=1	123	131
	Agricultural extension n=4	141	140
Others n=4	Community science n=4	217	416
Overall average	N=74	157	253
	Min.- Max.	31-539	63-622

In terms of social science division, number of citations from national and international publications was 123 and 275 in Agricultural Economics department. In Agricultural Extension department, average number of citations from national publications was 141 and 140 from international publications. In Community Science

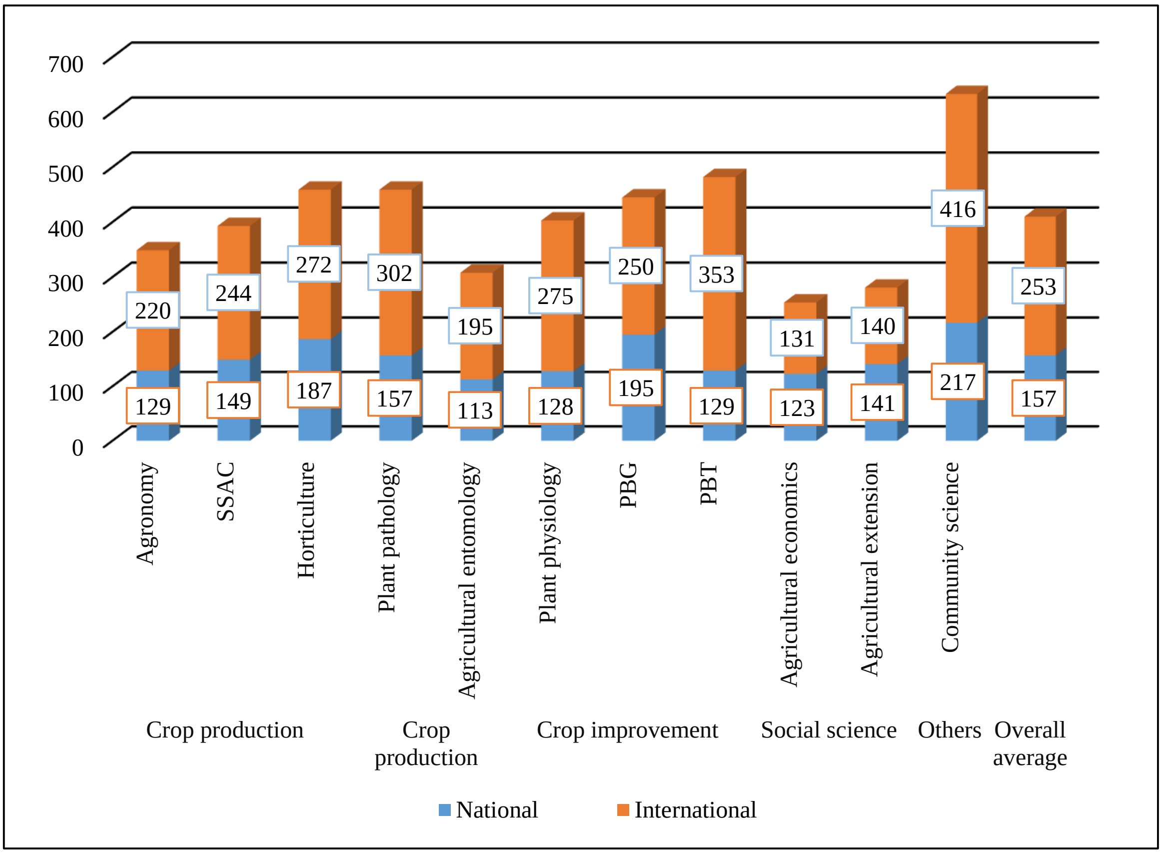


Fig. 39: Geographic wise distribution of average number of citations of theses under each department

department, average number of citations under national publications was 217 whereas 416 under international publications.

Overall analysis indicates that highest average number of citations for international and national publications was 416 and 217 from Community science department respectively. Lowest average number of citations under international was 131 from Agricultural Economics department and as for national publications it was 113 from Agricultural Entomology department.

Therefore, it can be inferred that based on average, international publications were cited more than Indian publications irrespective of departments except in Agricultural Extension though the difference was very little. Majorly approached international publications were from United States of America (USA), Netherlands, United Kingdom (UK) and China. It may be because very less research works were published in that area of study in Indian publications or their research works closely align with those of international publications which emphasises researchers' results. In such case researchers approached global literature for their research fulfilment. These results were similar in line with the findings of Hiremath and Sangen (1988).

4.3.2.3 Average Number of Citations

It can be operationalised as average number of citations per dissertation department wise. The results of the findings are reflected in the following table 48:

Table 48 and fig. 40 presents the data regarding average number of citations per theses department wise. It can be observed from study that on an overall average '404' citations were cited among all theses irrespective of departments. With a range of '652' lowest number of citations were from an Agricultural Entomology department thesis while highest number was recorded from a Plant Breeding and Genetics department thesis.

Under crop production division, average number of citations in Agronomy department theses was 349 with range of '371' recording minimum (224) to maximum (595) number of citations. In Soil Science and Agricultural Chemistry (SSAC) and Horticulture department theses average number of citations was 386 and 460 with range

297 and 523 respectively. The highest number of citations was 561 and 743 while lowest number was 264 and 220 in SSAC and Horticulture department respectively.

Table 48: Distribution of theses based on average number of citations

Division	Department	Average number of citations	Min.- Max.	Range
Crop production n=33	Agronomy	349	224-595 (n=14)	371
	SSAC	386	264-561 (n=8)	297
	Horticulture	460	220-743 (n=11)	523
Crop protection n=12	Plant pathology	458	260-826 (n=6)	566
	Agricultural entomology	308	191-395 (n=6)	204
Crop improvement n=19	Plant physiology	403	203-664 (n=5)	461
	PBG	445	272-843 (n=13)	571
	PBT	482	332-632 (n=2)	300
Social science n=5	Agricultural economics	254	254 (n=1)	254
	Agricultural extension	281	205-361 (n=4)	156
Others n=4	Community science	633	448-827 (n=4)	379
Total N=74	Overall Average	404	191-843 (N=74)	652

By looking at crop protection division, average number of citations in Plant Pathology department were 458 with range of 566 having lowest (260) number of citations and highest with 826 citations in a thesis. In Agricultural Entomology department, with a range of 204 average number of citations was 308 with minimum (191) and maximum (395) number of citations.

Meanwhile, in crop improvement division, average number of citations in Plant Physiology department was 403 with range 461 and highest (664) and lowest (203) number of citations. Plant Breeding and Genetics department recorded 445 as average

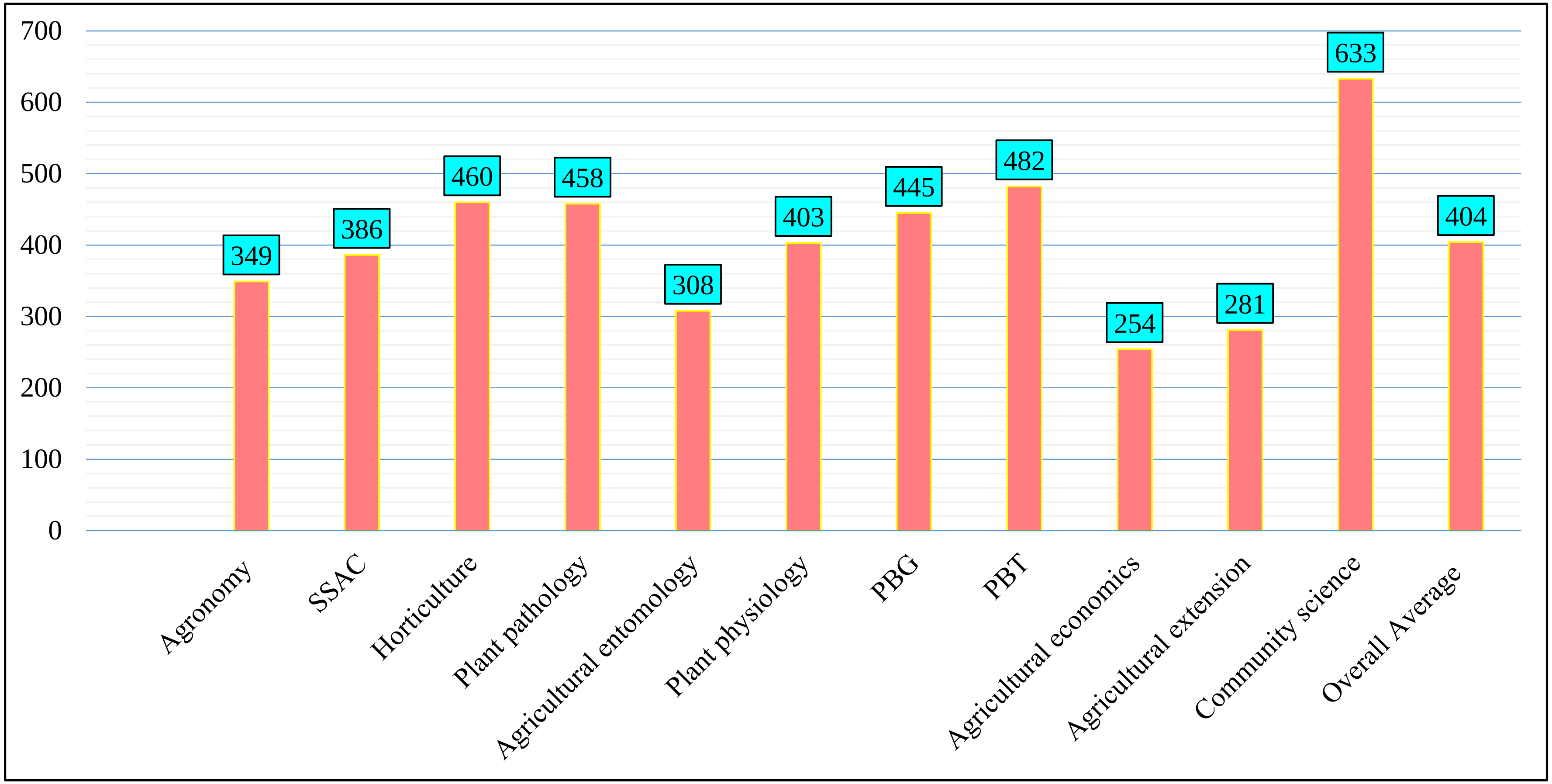


Fig. 40: Distribution of theses under each department based on average number of dissertations per dissertation

number of citations with range 571 recording highest (843) and lowest (272) number of citations whereas in Plant Biotechnology department theses the average number of citations were 482 with range 300 with 632 and 332 as highest and lowest number of citations respectively.

In terms of social science division, 254 was the number of citations recorded in Agricultural Economics thesis. In Agricultural Extension department theses, average number of citations was 281 with range of 156 recording highest and lowest number of citations as 361 and 205 respectively. As for Community Science department theses, average number of citations was 633 with range of 379 and recording minimum and maximum number of citations as 448 and 827 respectively.

Overall analysis of the table 48 showed that highest (633) average number of citations was from Community Science department and the lowest (254) in Agricultural Economics department. Highest (566) range was recorded in Plant Pathology department meanwhile lowest (204) in Agricultural Entomology. The findings were partially similar in line with Banateppanvar *et al.* (2013).

4.4 PERSONAL AND SOCIAL CHARACTERISTICS OF STUDENTS AND TEACHERS

For the present study various personal and social characteristics of respondents are studied

4.4.1 Personal and social characteristics of students

A total of ‘six’ independent variables were selected through judges’ rating and the results are presented under the following sub-headings:

4.4.1.1 Age

4.4.1.2 Gender

4.4.1.3 Locality

4.4.1.4 Educational background

4.4.1.5 Parental annual income

4.4.1.6 Research skills

4.4.1.1 Age

Age, in this study refer to number of years completed by respondent at the time of investigation. The age of students is classified based on the average chronological order after investigation and results are presented in table 49**.**

Table 49: Distribution of respondents based on age

Category	Age of students (in years)	f	%
Above mean	≥28	15	30.00
Mean	27	20	40.00
Below mean	≤26	15	30.00
	Total	50	100.00
Min.= 26; Max. 28			

From above table and fig. 41 it was clear that 40.00 per cent of the students fell under mean category (27) of age where 30.00 per cent fell under above mean (≥28) and below mean (≤26) category respectively. The minimum and maximum age was 26 and 28 years respectively.

The reason behind this might be because the respondents are students from different years of study and some may have taken a year or two gap in search of job or coaching after their master's degree.

4.2.1.2 Gender

Gender in this study was operationally defined as distinction between male and female based on biological distinction. The results are tabulated in table 50.

On glance at table 50 and fig. 42, it can be interpreted that about 82.00 per cent of respondents were female while only 18.00 per cent were male.

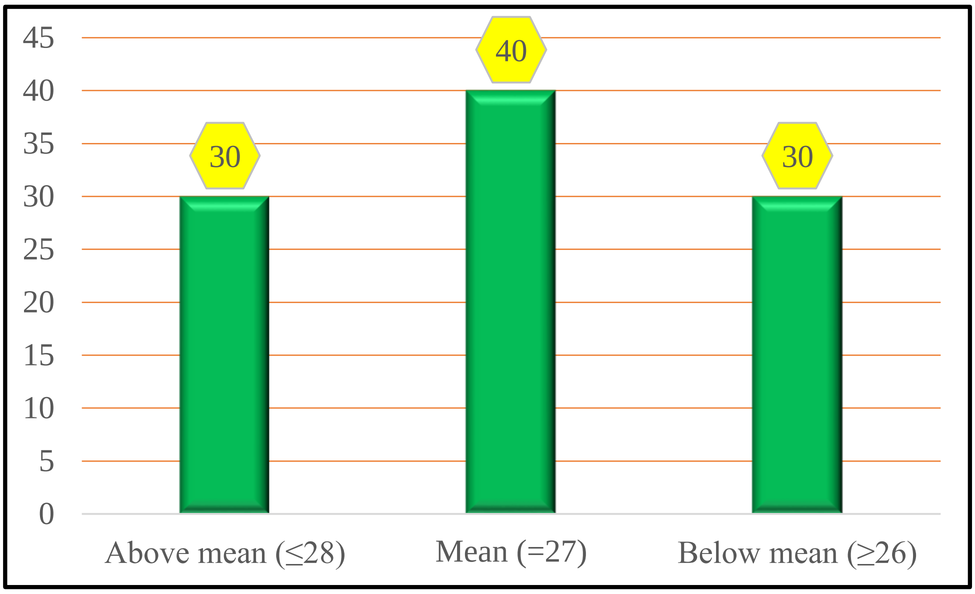


Fig. 41: Percentage distribution of student respondents based on age

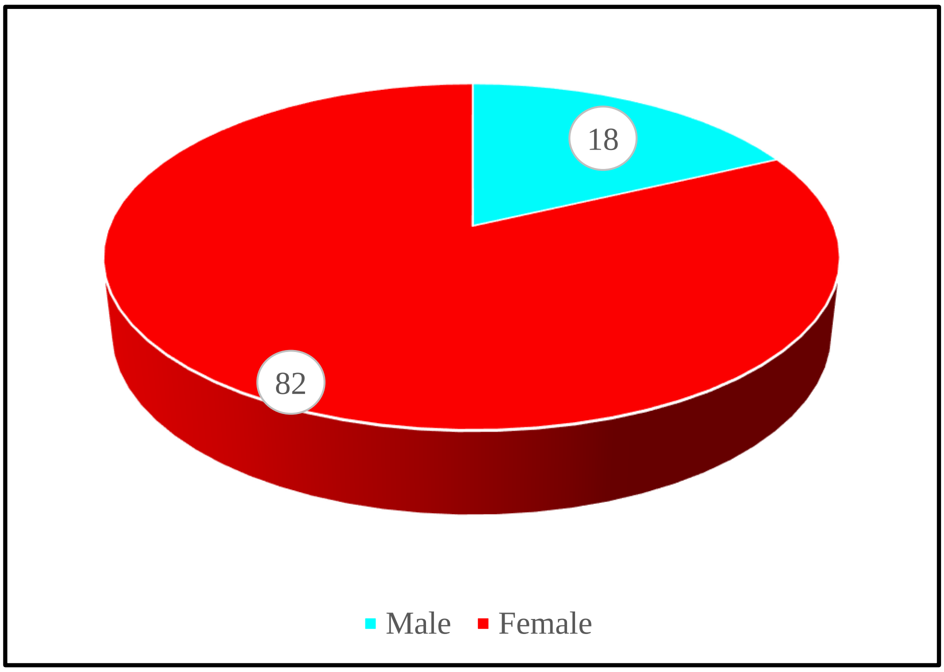


Fig. 42: Percentage distribution of students based on gender

Table 50: Distribution of respondents based on gender

Gender	Frequency	Percentage
Male	9	18.00
Female	41	82.00
	50	100.00

This infers that male are more slanted towards job and career settlement earlier rather than females who usually go for higher education after master's for secured career. Also, it can be construed that more females get admission for higher education in agriculture when compared to male.

4.4.1.3 Locality

Locality of respondents refer to village, town or city that respondents were native of and the results are presented in table 51.

On cursory look at above table 51 and fig. 43, it can be reflected that 50.00 per cent of the students belonged to village followed by 34.00 per cent from town and 16.00 per cent from city. Hence, it can be concluded that half of the respondents were from rural area and probably with agriculture background. It also shows their interest towards agriculture research implying a positive attitude towards the same by students from rural background.

Table 51: Distribution of respondents based on locality

Locality	Frequency	Percentage
City	8	16.00
Town	17	34.00
Village	25	50.00
	50	100.00

4.4.1.4 Educational Background

Educational background in this study was operationally defined as education the respondents have undergone. The results are presented in table 52 and 53.

On perusal of data in table 52, it can be understood that 40.00 per cent of students studied in government school up to tenth class followed by 36.00 per cent in aided private school and 24.00 per cent in unaided private school. While 44.00 per cent of students attended aided private school or college in twelfth standard, 32.00 per cent attended government colleges/ schools and 20.00 per cent in unaided private schools or colleges. It was promising to observe that about 96.00 per cent of students completed their undergraduate from government colleges and only 4.00 per cent from aided private colleges. All students pursued their master degree from government institutions only.

Table 52: Distribution of respondents based on type of school or university

Category	Type of school/University	Frequency	Percentage
Upto X	G	20	40.00
	AP	18	36.00
	UAP	12	24.00
	Total	50	100.00
XII	G	16	32.00
	AP	22	44.00
	UAP	10	20.00
	Total	50	100.00
B.Sc.	G	48	96.00
	AP	2	4.00
	UAP	0	00.00
	Total	50	100.00
M.Sc.	G	50	100.00
	AP	0	00.00
	UAP	0	00.00
	Total	50	100.00

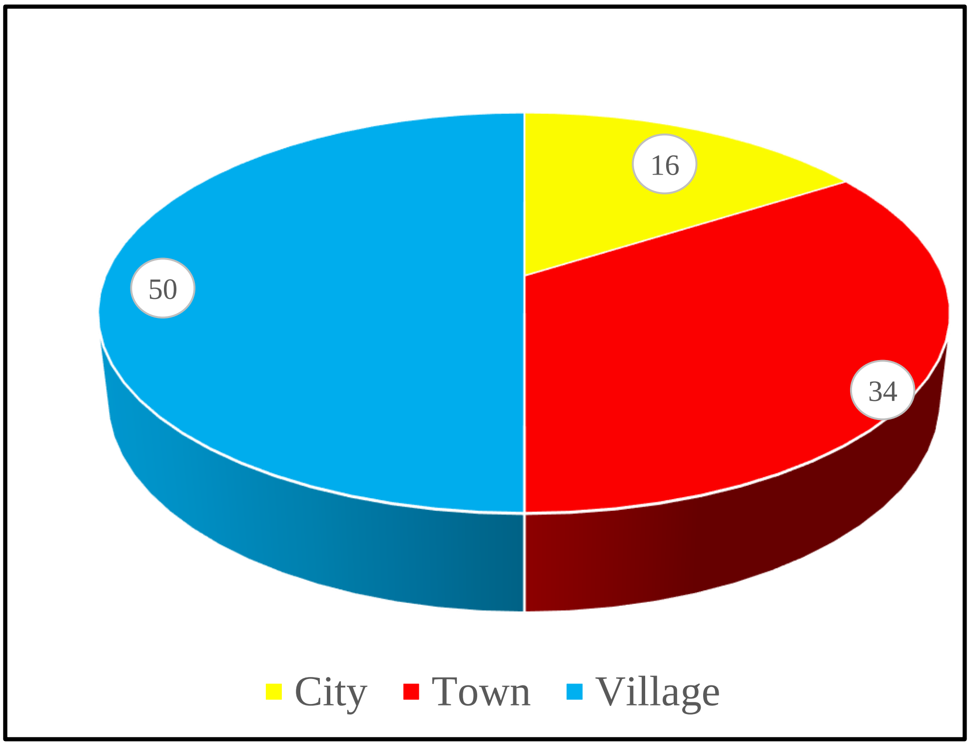


Fig. 43: Percentage distribution of students based on locality

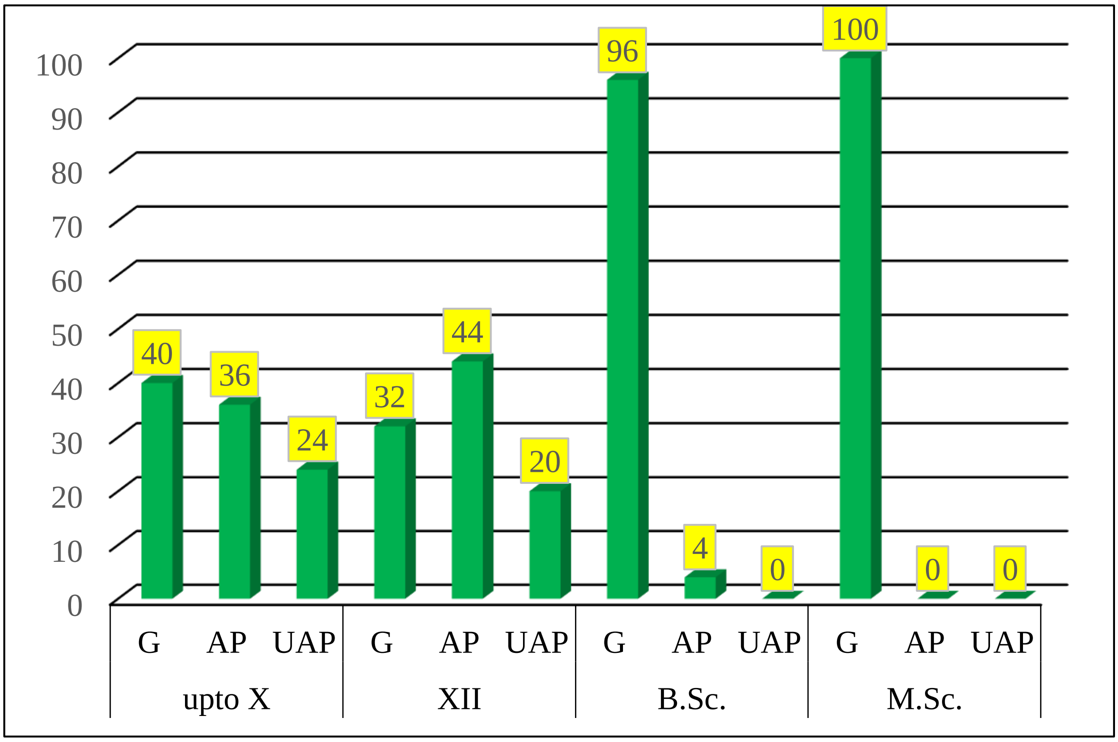


Fig. 44: Percentage distribution of students based on type of school/university they attended

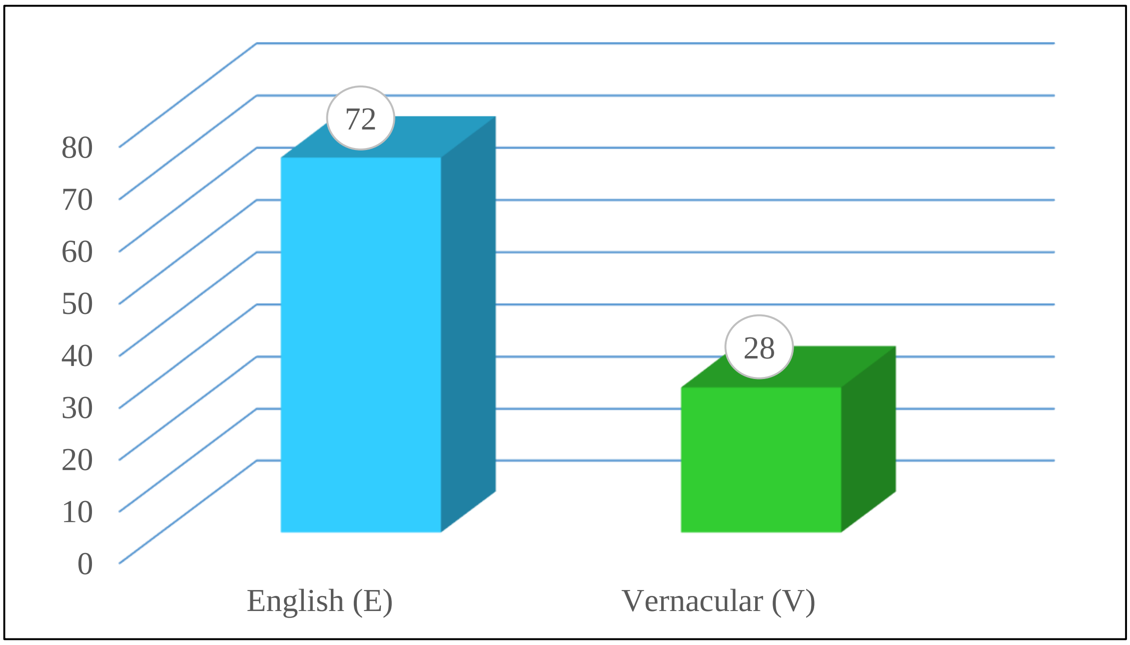


Fig. 45: Percentage distribution of students based on medium of instruction

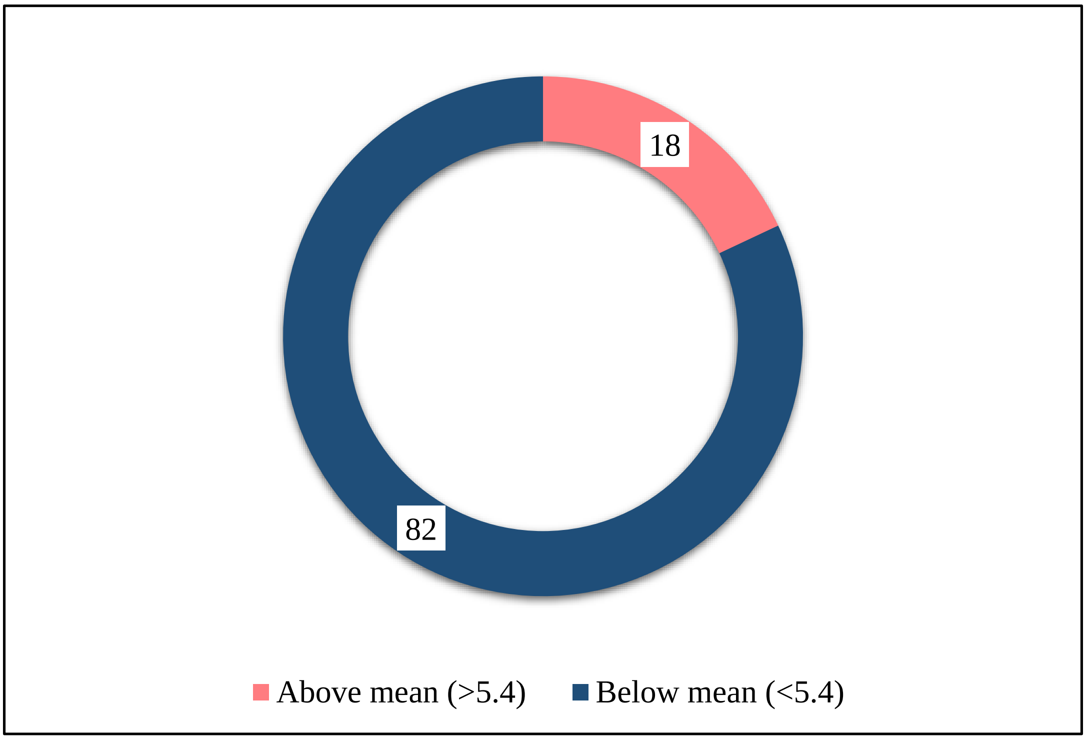


Fig. 46: Percentage distribution of students based on their parental annual income

Table 53: Distribution of respondents based on medium of instruction

Type of medium	Frequency	Percentage
English (E)	36	72.00
Vernacular (V)	14	28.00
	50	100.00

In case of medium of instruction during schooling, it was observed from table 53 and fig. 45 that 72.00 per cent of respondents studied in English medium and 28.00 per cent from vernacular medium.

Therefore, from above table 52 and 53, it shows that medium of instruction in English is becoming prominent in government schools throughout India. It shows the interest of students to pursue the English language that deemed to be very important for career opportunities either in government, private or global sectors.

4.4.1.5 Parental annual income

Parental annual income in this study refer to as income in rupees per annum earned by student's parents. The results are reflected in table 54.

Table 54: Distribution of respondents based on parental annual income

Category	Parental annual income (in Lakhs)	Frequency	Percentage
Above mean	>5.4	9	18.00
Below mean	<5.4	41	82.00
	Total	50	100.00
Mean= 5.4 ; Min. income=0.66; Max. income=25			

On analysis of table 54 and fig. 46**,** it was revealed that 82.00 per cent of the parents of PhD students had and annual income less than 5.4 lakhs with mean as check and only 18.00 per cent with more than 5.4 lakhs. It can be inferred that more than 3/4th of students come from low financial background considering the living conditions that exist in India. It can also be due to majority of students hailing from rural areas as mentioned in previous table.

4.4.1.6 Research skills

Research skills in the study was operationally defined as ability to search for, locate, extract, establish, evaluate and use of information gathered that is relevant to a particular topic. The results are presented under following sub-divisions:

4.4.1.6.1 Information seeking skills

Information seeking skills was operationally defined as ability to search, use, and evaluate information gathered. The results are presented in table 55.

Table 55: Distribution of information seeking skills as perceived by students

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I am aware that information found in journals are more often checked, edited and criticized compared to information found in magazines	22	23	2	0	381	1	3
2	I am aware that information can be obtained through various means (e.g., electronic media, images, audio and video)	37	12	0	0	233	3	1
3	I am aware that the secondary source is the source that discusses the work of others	28	16	0	0	204	7	6
4	I identify and look for synonyms, themes or key words that can be used to find information based on my topic	24	22	0	0	208	6	4
5	In order to find information, I read general texts like dictionaries or encyclopedia articles to gain more understanding on the terminologies used in my topic	12	23	2	0	158	11	12

6	I am confident that I can find a book/article based on the title given	30	26	2	0	258	2	9
7	I will look at alternative options to find out information again in order to get exactly what I want if it is not successful the first time	27	19	0	0	211	5	4
8	I evaluate the accurateness of the content by reading other sources mentioned by the writer	10	27	3	0	164	10	10
9	I realize that time is a factor that influences the relevance of the information to my topic of research	25	25	0	0	225	4	0
10	When searching for information, I arrange each item systematically	11	33	2	0	191	9	4
11	I write down the important concepts myself using my own words	17	27	3	0	199	8	3

SA-Strongly agree, A-Agree, UN-Undecided, D-Disagree, SDA-Strongly disagree

On examining table 55 and fig. 47**,** it was found that the among ‘eleven’ statements under information seeking skills, top three ranks were given to ‘statement 1’, ‘statement 6’ and ‘statement 2’ as 1st, 2nd and 3rd rank respectively whereas lowest rank was given to ‘statement 5’ as perceived by the students. This indicates that respondents were confident in searching the information quickly and accurately from journals, books, papers *etc.*, but failed to understand and/or evaluate the accurateness of content and arrange them systematically using their own words.

4.4.1.6.2 Methodology skills

Methodology skills in this study refers to identifying and designing appropriate research procedure, understanding the limitations and scope of research study. The results are illustrated in table 56.

Table 56: Distribution of respondents based on methodology skills

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I have the ability to plan a research	9	38	0	0	197	4	3
2	I have the knowledge and ability to develop a research question	5	40	0	0	185	5	5
3	I have the ability to search for a research problem	8	35	0	0	180	7	7
4	I have the ability to do a comprehensive review of literature	18	30	0	0	210	2	2
5	I have the knowledge and skill to design a scientific experiment study	6	35	2	0	174	10	7
6	I have the knowledge in selecting the appropriate instrument	4	38	2	0	176	8.5	6
7	I have the knowledge and skill to develop an appropriate instrument	0	29	11	0	138	11	10
8	I have the required skills in collecting survey data	8	36	0	0	184	6	6
9	I have the ability to write an abstract	14	33	0	0	202	3	3
10	I have the preparing a manuscript for publication	15	34	0	0	211	1	1
11	I have the knowledge and skill to choose the correct and appropriate method for analysis of data	6	35	3	0	176	8.5	6
12	I have the ability to interpret the results of a research study and draw correct inferences	7	34	2	0	175	9	7

On scrutinizing data from table 56 and fig. 48, among ‘twelve’ statements mentioned in methodology skills, ‘statement 10’, ‘statement 4’ and ‘statement 9’ ranked as 1st, 2nd and 3rd respectively while the last rank was given to ‘statement 11’. It can be inferred that respondents possessed the ability to prepare a review of literature, manuscript, abstract *etc.*, but showed lack in proper assertiveness in interpreting and drawing inferences, skill in designing experiment study or in developing an appropriate instrument.

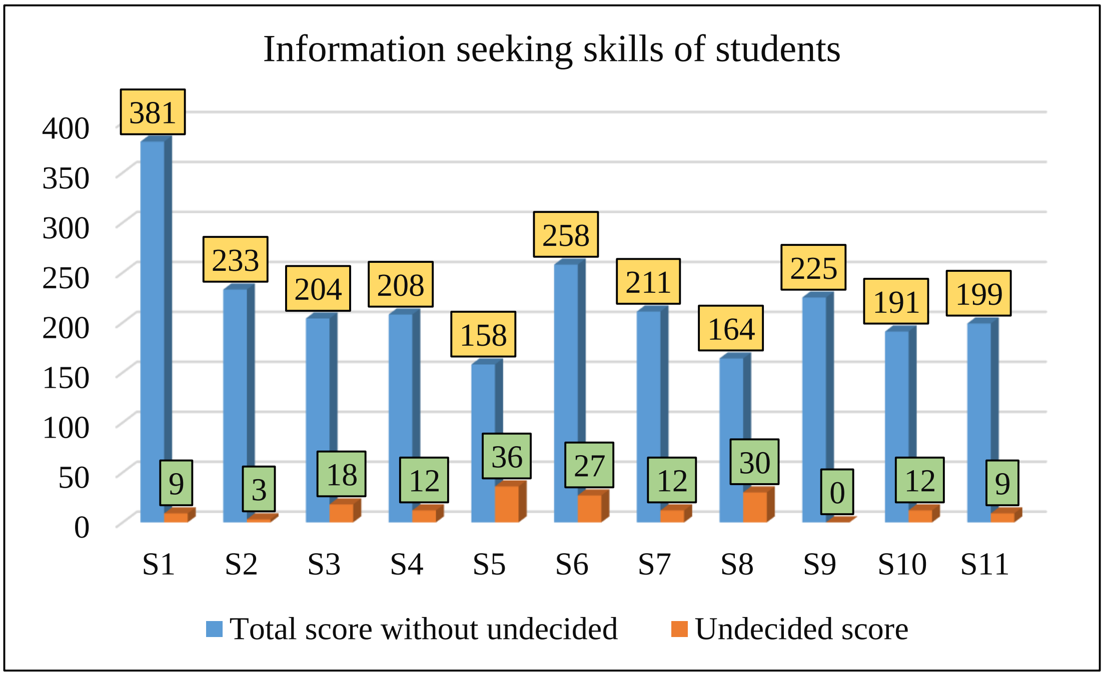


Fig. 47: Distribution of respondents scores based on information seeking skills

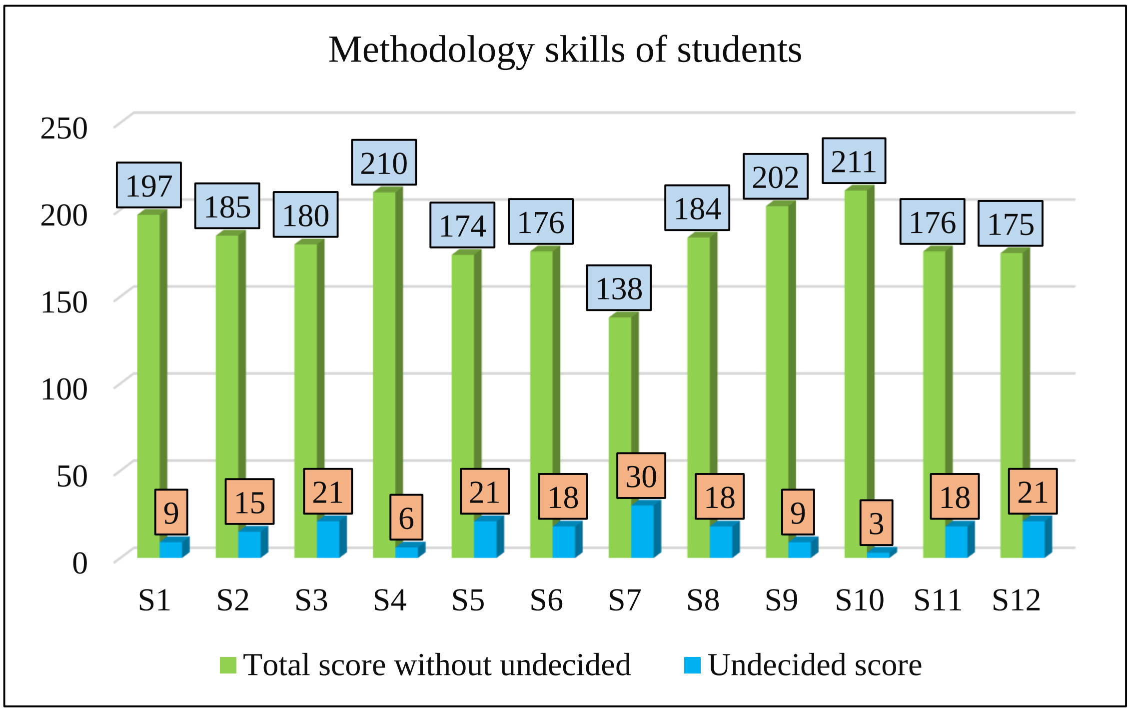


Fig. 48: Distribution of respondents score based on methodology skills

4.4.1.6.3 Problem solving skills

Problem solving skills of students refers to the ability to identify, define and analyse problems, to create solutions, evaluate them and to choose the best solution for a particular context. The following table 57 illustrates the results:

Table 57: Distribution based on problem solving skills of respondents

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I have ability to apply scientific methods in the process of identifying the components of research	6	29	2	0	150	5	13
2	Before finalizing the research topic, I use scientific methods to describe the cause-effect of components of the research problem logically and relevantly	1	35	6	0	157	4	8
3	I have ability to draw conclusions and analyse the influence of research outcome	12	42	0	0	228	1	2
4	I have the confidence and ability to weigh one solution against another with reasoning skills	8	34	2	0	182	3	6
5	I usually take feedback from peers and superiors and reflect on the results of research outcomes	21	23	3	0	203	2	3

Among the ‘five’ statements mentioned in the table 57 and fig. 49**,** ‘statement 3’ ranked first followed by statements 5, 4, 2 and 1 in second, third, fourth and fifth place respectively. It can be because students were poised in analysing and taking feedback to reflect them on research outcomes but seemed having little difficulty in applying scientific methods and finalising research topic or problem logically and relevantly.

4.4.1.6.4 Statistical/ analytical skills

Statistical skills refer to the ability of researchers to carry out data collection and analysing procedure besides understanding them. The results are presented in table 58.

Looking at table 58 and fig. 50, a total of 'ten' statements were presented under statistical/analytical skills of which top three rankings were given to 'statement 4', 'statement 5' and 'statement 9' as first, second and third respectively. This can be because of respondents' ability in preparing excel sheets, analysing, interpreting and presenting measurements as data sets with illustrations, graphs, tables *etc.*, and the lowest rank was given to 'statement 8' as respondents were less assertive in terms of constructing hypotheses and analysing significance of test with proper statistical tests and methods required for interpreting research conclusions.

4.4.1.6.5 Communication skills

Communication skills of researchers was operationally defined as the ability to write and present the research and its findings. The results are presented in table 59.

On perusal of data illustrated in table 59 and fig. 51, that about 'nine' statements were evaluated by students based on their perception towards communication skills during research where first, second and third ranks were given to 'statement 8', 'statement 7' and 'statement 5' respectively which indicates that students were able to communicate with particular audiences in terms of their needs by asking questions and also explaining purpose, objectives and conclusions of their research. Lowest rank was given to 'statement 8' which means students had least confidence in writing article for peer reviewed journals.

Table 58: Distribution based on statistical/analytical skills of respondent

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I am more interested in qualitative methods rather than quantitative methods in research	4	20	10	0	120	8	16
2	It is difficult to understand statistical procedures	1	21	15	0	119	9	13
3	I am confident in using statistical procedures	5	26	6	3	144	6	10
4	I know how to prepare spreadsheets models/ use MS excel to store the data	11	34	0	5	196	1	0
5	I can create, calculate, analyse, interpret and present statistical measurements from data sets	8	36	0	3	187	2	3
6	I can manipulate and analyse quantitative data using common probability distributions and statistical functions	1	24	13	4	131	7	8
7	I can perform data analysis accurately by using MS Excel or R programme or SPSS package or other appropriate tools	5	30	2	6	157	4	7
8	I can construct hypothesis and analyse test of significance with proper parametric or non- parametric tests	4	20	5	5	115	10	16
9	I have ability to work/interpret with graphs, figures, tables, illustrations, etc., to present results more convincing	13	29	0	5	186	3	3
10	I found lectures on data analysis and other descriptive statistics useful during my coursework	10	22	5	7	155	5	6

Table 59: Distribution of respondents based on communication skills

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I am able to write review of literature, methodology, results and discussion with minimum or without plagiarism	13	28	2	0	181	8	7
2	I am able to write thesis by adhering to research guidelines accurately	13	29	2	0	185	7	6
3	I am able to do a research presentation with confidence	18	23	2	2	193	5	5
4	I am able to speak the local language to gather information and communicate with respondents or other relevant people	25	16	2	2	195	4	5
5	I have ability to ask questions to respondents and explain the purpose, objectives, conclusions of the research	21	21	3	2	197	3	3
6	I am able to tailor the communication to the needs and knowledge level of a particular audiences	19	25	3	2	203	1	1
7	Participation in seminars and conferences improves my confidence in presenting the outcomes of research	19	25	2	2	201	2	2
8	I have the ability to write scholarly articles for high refereed journals	6	30	3	2	158	9	9
9	I have ability to speak as well as give feedback in English confidently while presenting the research outcome	17	24	2	2	187	6	5

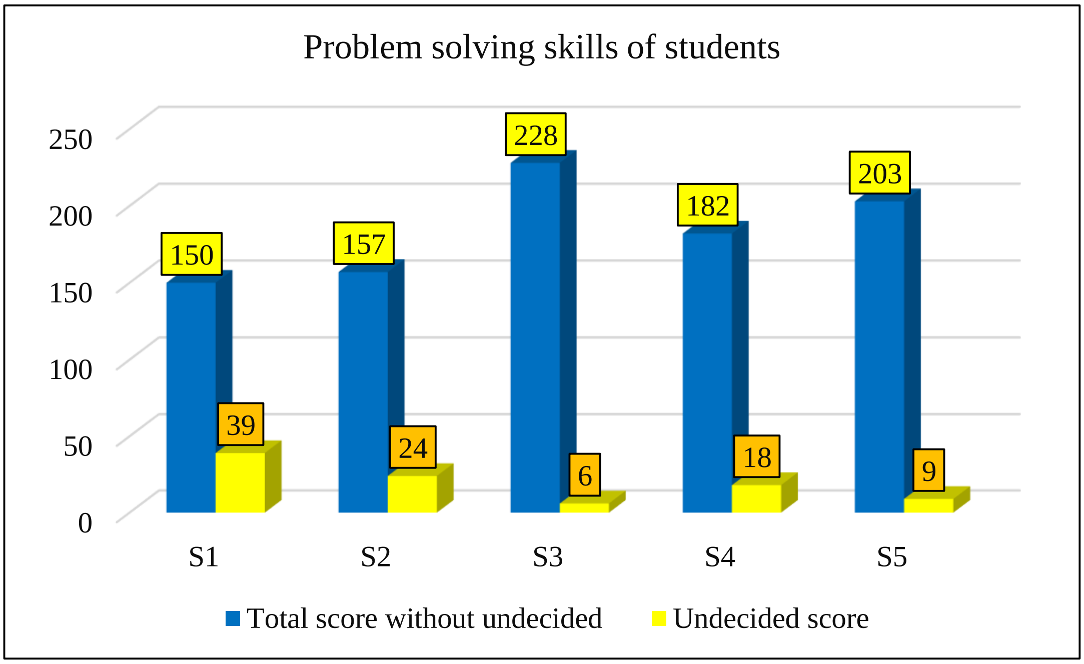


Fig. 49: Distribution of respondents score based on problem solving skills

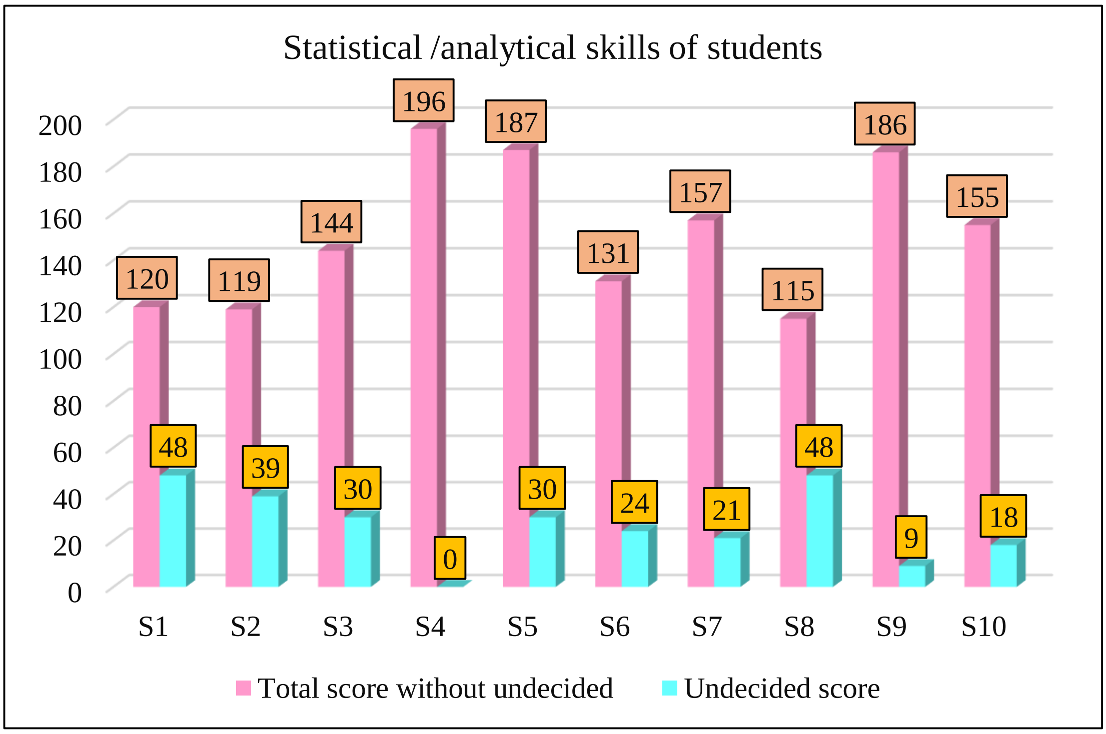


Fig. 50: Distribution of respondents scores based on statistical/ analytical skills

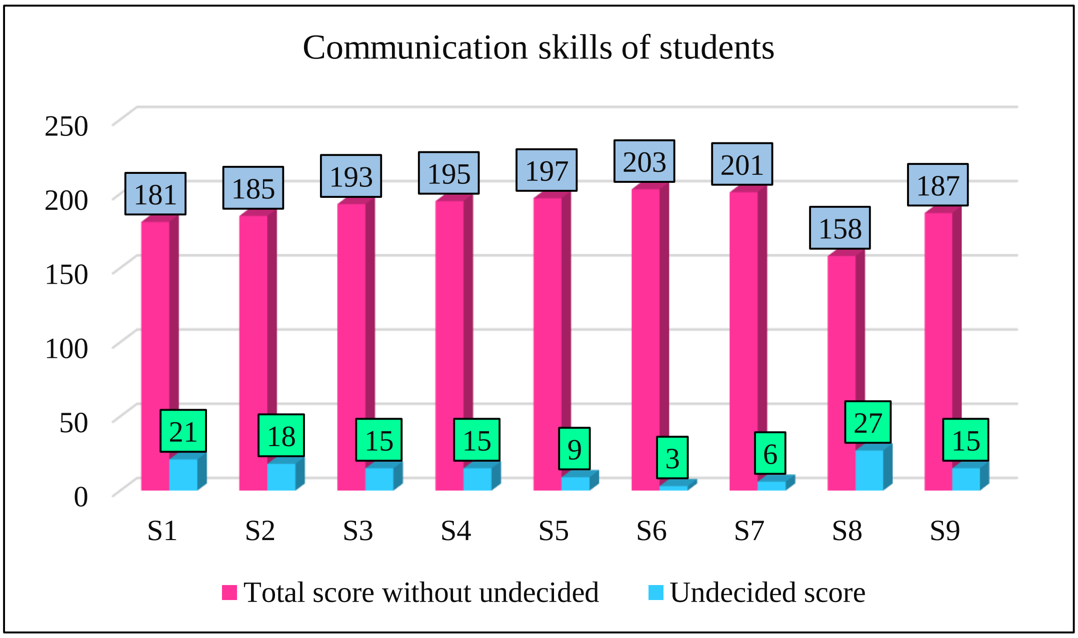


Fig. 51: Distribution of respondents scores based on communication skills

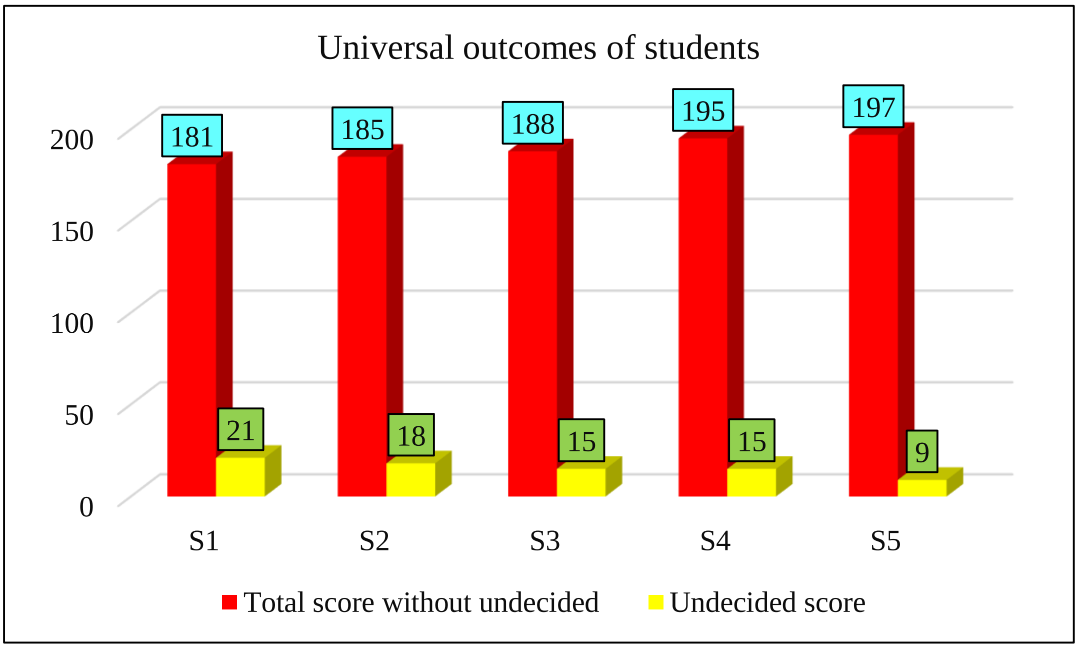


Fig. 52: Distribution of respondents scores based on universal outcomes

4.4.1.6.6 Universal outcomes

Universal outcomes of research refer to general skills necessary for researcher in conducting the research. The results are presented in table 60.

Table 60: Distribution of respondents based on universal outcomes

Sl.No.	Statements	SA (5)	A (4)	DA (2)	SDA (1)	Total score	Rank	UN (3)
1	I have ability to think creatively/synthetically	13	28	2	0	181	5	7
2	I have ability to think critically/logically to solve problem	13	29	2	0	185	4	6
3	I can control emotions well while conducting research	18	23	2	2	188	3	5
4	I am not a passive recipient of information but a participant in creation of understanding	25	16	2	2	195	2	5
5	I have knowledge to determine the correct sample size of study, to define the correct no. of treatments and replications, to select appropriate research design	21	21	3	2	197	1	3

It can be observed from table 60 and fig. 52, that highest rank was given to 'statement 5' whereas lowest rank was given to 'statement 1'. This specifies that students were more poised in determining sample size and selecting appropriate research design by actively participating in creation. Majority of students perceived that they lack the ability to think creatively or synthetically while making decisions during research work.

4.4.2 Personal and social characteristics of teachers

The results representing the personal and social characteristics of the teachers are presented under following independent attributes:

4.4.2.1 Age

4.4.2.2 Gender

4.4.2.3 Educational Qualifications

4.4.2.4 Guidance experience

4.4.2.5 Number of PhD students previously guided/guiding

4.4.2.6 Number of PhD students currently guiding

4.4.2.7 Externally aided projects

4.4.2.1 Age

Age in this study refer to number of years completed by the respondent at time of investigation. The results are tabulated in table 61.

Table 61: Distribution of respondents based on age

Class Limit	Frequency	Percentage
43-47	10	33.33
48-52	10	33.33
>53	10	33.33
Total	30	100.00

It was interesting to note from above table that 33.33 per cent of respondents belonged to all the age groups 43-47, 48-52 and greater than 53 respectively. Hence, it can be inferred that all teachers were above age forty years and has more years in their service to university.

4.4.2.2 Gender

Gender in this study was operationally defined as distinction between male and female. The results are illustrated in table 62.

Table 62: Distribution of respondents based on gender

Gender	Frequency	Percentage
Male	5	16.67
Female	25	83.33
	30	100.00

From table 62 and fig. 54, it shows that 83.33 per cent of the teachers were female and only 16.67 per cent were male. This can be inferred that females are more inclined for teaching profession rather than males. With recent enrolment of teachers in to university implies that more percent of females are pursuing higher education in proportion.

4.4.2.3 Educational qualifications

Educational qualifications in this study refers to extent of formal education possessed by the respondent at the time of survey. The results are illustrated in table 63.

On perusal of data from table 63 and fig. 55, shows that all the respondents were qualified with doctoral degree. Among teachers who completed their master degree, 90.00 per cent were from KAU and 10.00 per cent were from other universities. Among teachers who did their PhD in KAU were 83.33 per cent and 16.67 per cent were from other university. It was also observed that about four respondents had done other specialisations. These results might be because teachers who are guiding PhD students require higher degree qualifications. This might have helped them to develop a positive attitude on research for students.

Table 63: Distribution of respondents based on educational qualifications

Sl.No.	Category	Sub-category	f	%
1	Master of Science (M.Sc.)	KAU	27	90.00
		Other	3	10.00
		Total	30	100.00
2	Doctor of Philosophy (Ph.D.)	KAU	25	83.33
		Other	5	16.67
		Total	30	100.00
3	Other		4	

4.4.2.4 Guidance experience

Guidance experience in this study was operationalised as to the number of years of experience in guiding completed by teachers from the time of starting their guideship. The results based on quartiles are presented in table 64.

Table 64: Distribution of respondents based on guidance experience

Category	Class limit (in years)	f	%
Low (<Q1)	<5	5	16.67
Medium (Q1-Q3)	5-15	18	60.00
High (>Q3)	>15	23	76.67
	Total	30	100.00

Looking at table 64 and fig. 56, it can be revealed that 76.67 per cent of the teachers had experience of guiding for more than 15 years followed by 60.00 per cent of teachers with five to fifteen years of experience and 16.67 per cent of teachers had less than 5 years of experience in guiding.

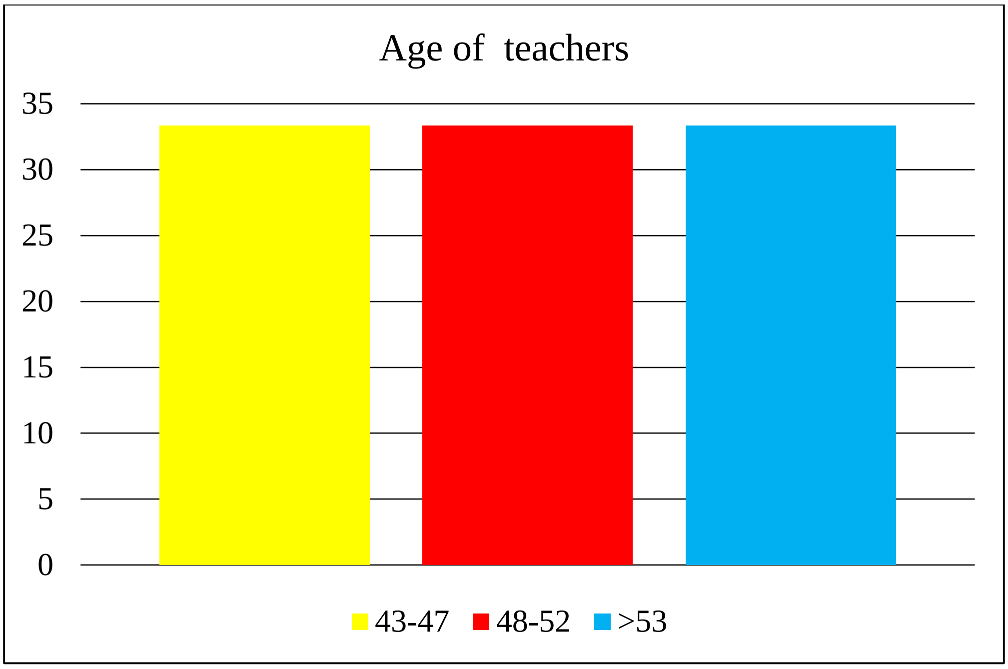


Fig. 53: Percentage distribution of teachers based on age

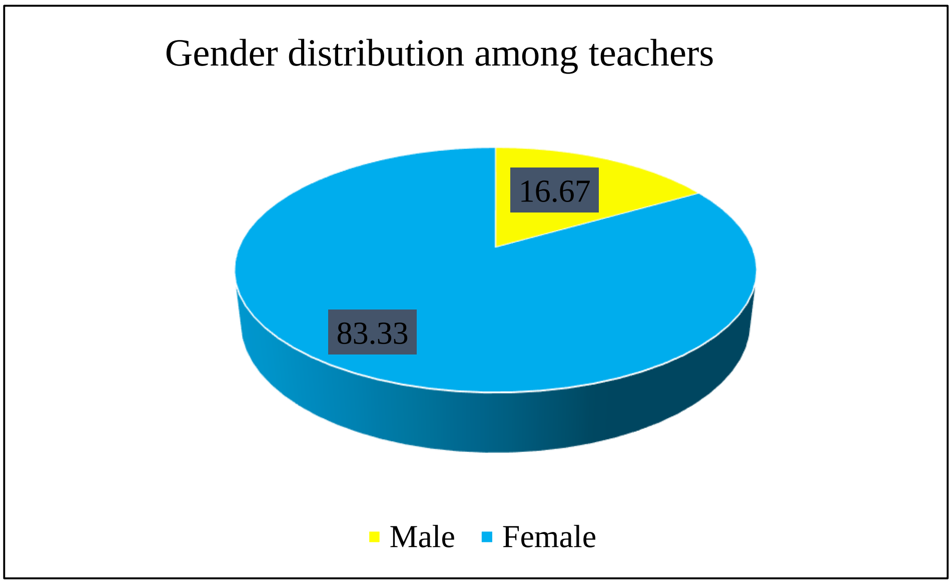


Fig. 54: Percentage distribution of teachers based on gender

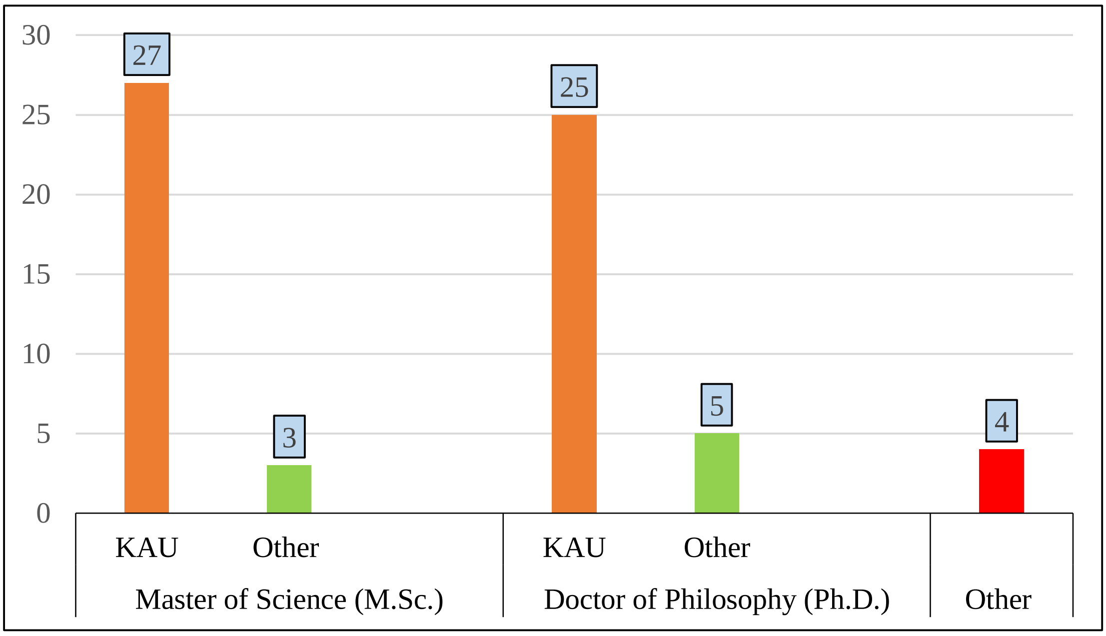


Fig. 55: Percentage distribution of teachers based on educational qualifications

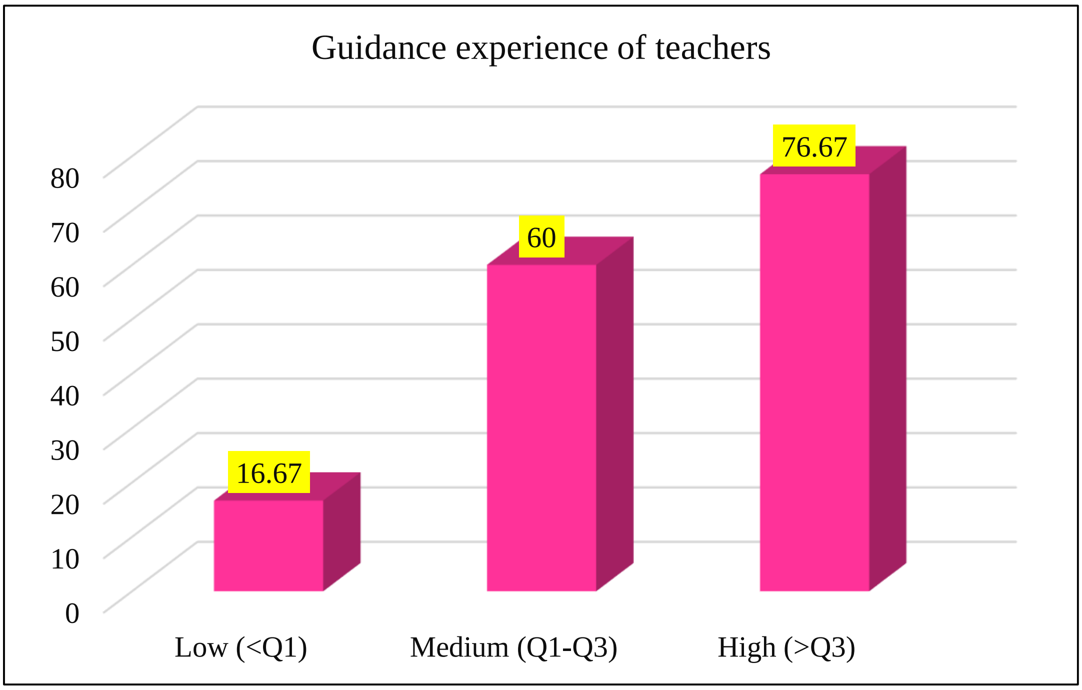


Fig. 56: Percentage distribution of teachers based on guidance experience

4.4.2.5 Number of students previously guided/guiding

This was defined as total number of PhD students the teachers had guided or guiding previously. The results are presented in table 65.

Table 65: Distribution of respondents based on number of students guided/guiding previously

Number of PhD students guided/guiding	f	%
1	21	70.00
2	5	16.67
3	3	10.00
≥4	1	3.33
Total	30	100.00

A cursory look at table 65 and fig. 57, revealed that majority (70.00%) of the teachers has guided or guiding single Ph.D. student previously followed by 16.67 per cent teachers guided or guiding two students, 10.00 per cent with three students and 3.33 per cent with four or above has been guided or guiding previously.

4.4.2.6 Number of students currently guiding

It refers to the total number of PhD students the teachers were currently guiding. The results are illustrated in table 66.

Table 66: Distribution of respondents based on number of students currently guiding

No. of students currently guiding	f	%
1	8	26.67
2	4	13.33
3	14	46.67
4	4	13.33
Total	30	100.00

The table 66 and fig. 58 illustrates that 46.67 per cent teachers were currently guiding three students followed by 26.67 per cent guiding only one student and 13.33 per cent teachers guiding two and four students respectively. Due to limited staff members in some of the departments teachers are guiding more students which can compromise the quality of research which urges the need to recruit more qualified staff who can guide doctoral students.

4.4.2.7 Externally aided project

Externally aided projects refer to projects that were financed by state government or any other agencies in states for augmenting the states' resources that play an important role in development process. The results are presented in table 67 and 68.

Table 67: Distribution of respondents based on number of externally aided projects as PI

Externally aided projects as PI	f	%
0	3	2.38
1-4	19	15.08
5-8	6	4.76
>8	2	1.58
Total	30	100.00

Table 68: Distribution of respondents based on projects per person

Externally aided projects (as PI)	Project per person
126	4.2

The outcomes of the table 67 and fig. 59, shown that 15.08 per cent of teachers had undertaken one to four externally aided projects as Principal Investigator (PI) followed by 4.76 per cent teachers commenced five to eight projects, 2.38 per cent teachers had not undertaken any projects and 1.58 per cent teachers took up more than

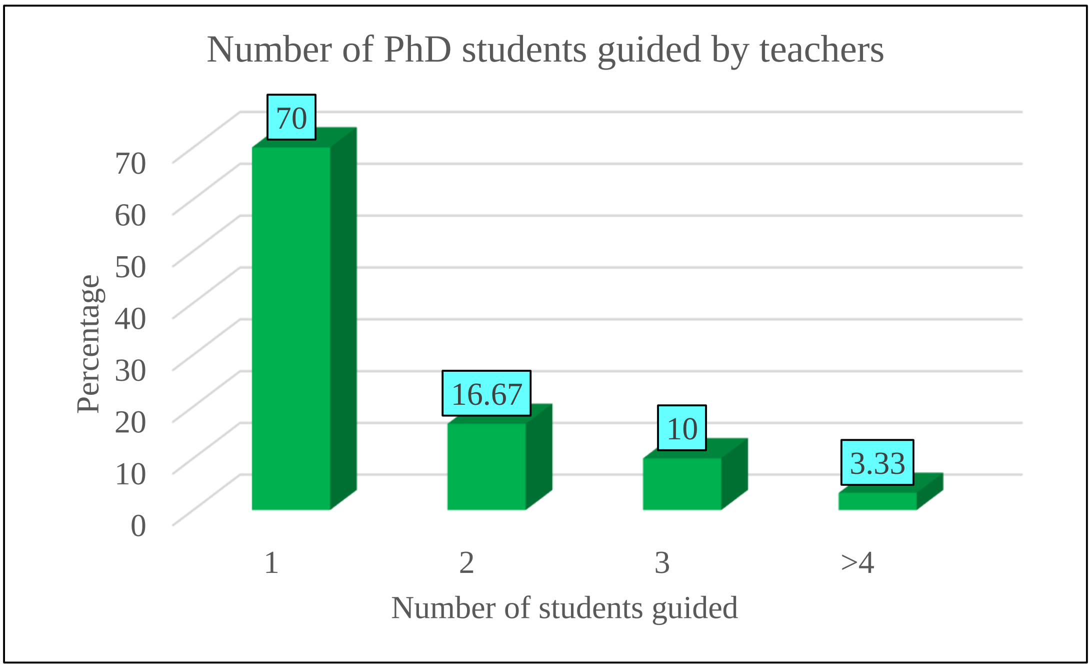


Fig. 57: Percentage distribution of teachers based on number of PhD students guided

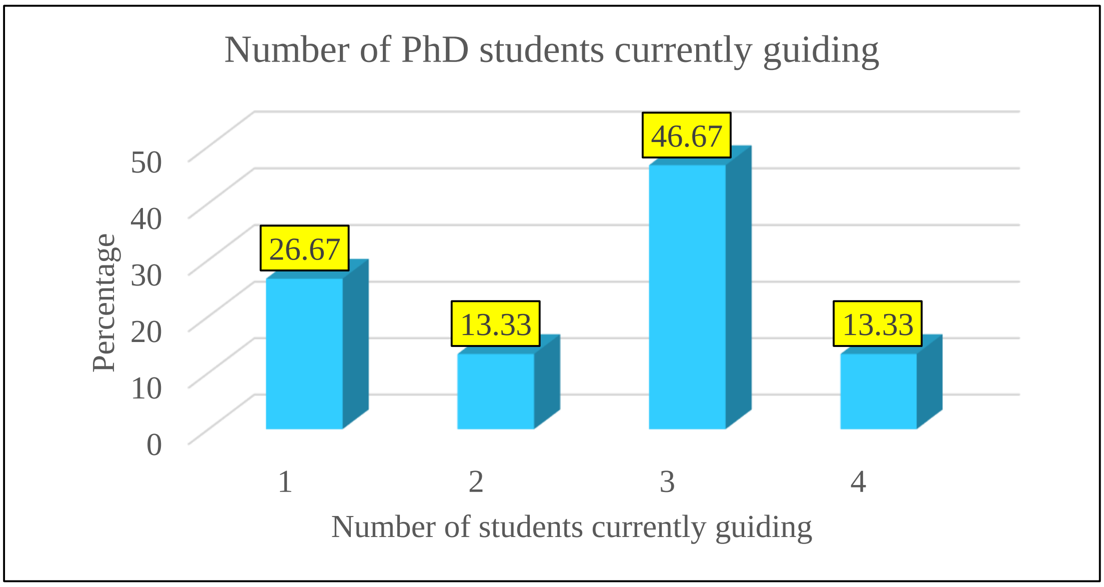


Fig. 58: Percentage distribution of teachers based on number of students currently guiding

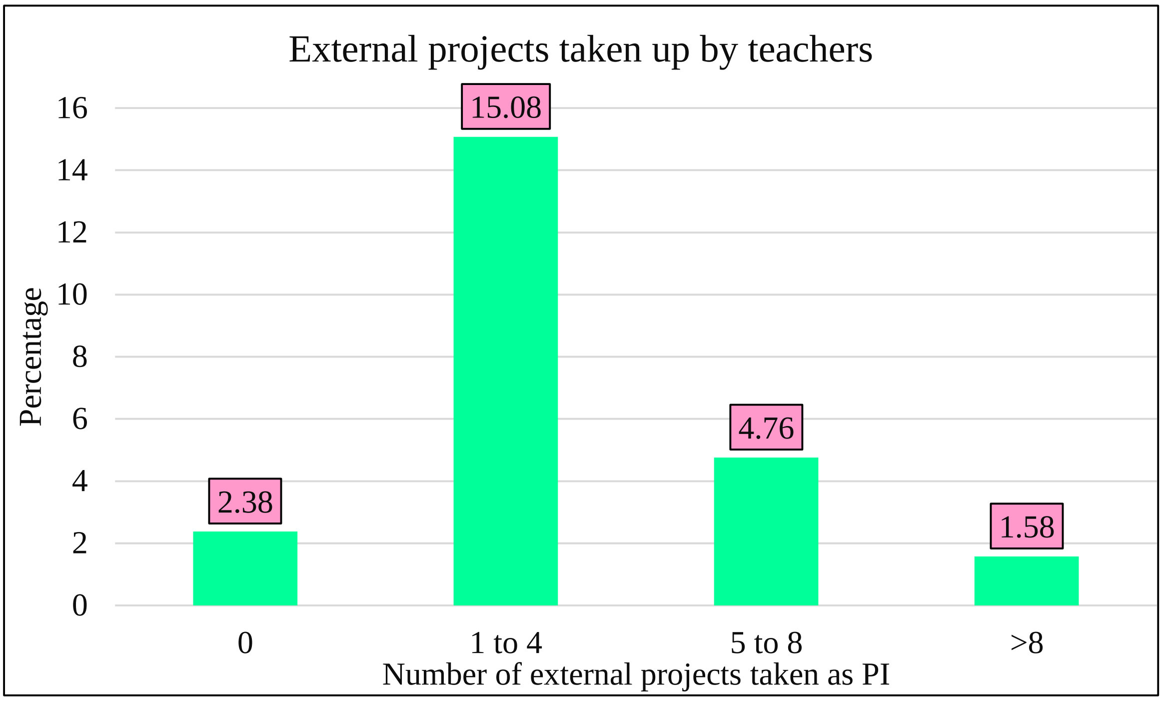


Fig. 59: Percentage distribution of teachers based on external projects taken up as Principal Investigator (PI)

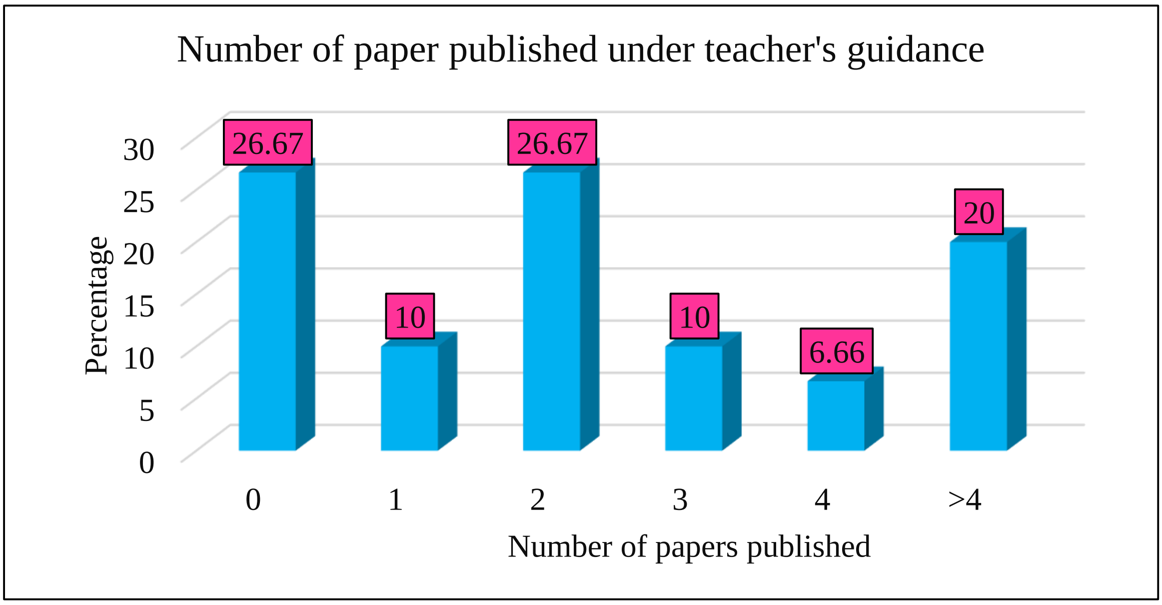


Fig. 60: Percentage distribution of teachers based on number of papers published under their guidance

eight externally aided projects. As indicated in table 68, a total of 126 projects were taken up so far by teachers and on an average four projects were undertaken per teacher which explains their ability to conduct research and guide students for doctoral research.

4.4.2.8 Number of papers published

It refers to total number of papers published by Ph.D. students under the guidance of teachers. The results are presented in table 69.

Table 69: Distribution of teachers based on number of papers published under their guidance

No. of papers published	f	%
0	8	26.67
1	3	10.00
2	8	26.67
3	3	10.00
4	2	6.67
>4	6	20.00
Total	30	100.00

It can be noticed from table 69 and fig. 60, that under the guidance of 26.67 per cent of teachers their students published two papers followed by 20.00 per cent with more than four papers, 10.00 per cent with one paper and three papers respectively and 6.67 per cent with four papers. This indicates that students under their guidance have published at least two articles in quality journals. While it was also observed that under the guidance of 26.67 per cent of teachers there were no articles published. It may be because the students under their guideship may have not completed their research work yet or in the process of conducting research.

4.5 OTHER IMPORTANT INDEPENDENT VARIABLES OF THE STUDY

4.5.1 Outcomes of research

The outcomes of the variables as per interest of researcher were presented under the following headings *viz.* resource availability as perceived by students and teachers; resource attainment difficulty as perceived by students and teachers; acquaintance support as perceived by students; publishing difficulty of students; research work environment and research satisfaction as perceived by students in table 70, 71 and 72.

Table 70: Distribution of respondents based on the resource availability, resource attainment difficulty, acquaintance support, publishing difficulty, research work environment, research satisfaction

Category	Score	Students n=50		Teachers n=30	
		f	%	f	%
Resource availability Resource availability refers to availability of funds, research material, raw materials and literature for the purpose of conducting research					
i. Literature					
Yes	1	39	78.00	22	73.33
No	0	11	22.00	8	26.67
Total		50	100.00	30	100.00
ii. Research material					
Yes	1	40	80.00	21	70.00
No	0	10	20.00	9	30.00
Total		50	100.00	30	100.00
iii. Raw materials					
Yes	1	33	66.00	21	70.00
No	0	17	34.00	9	30.00
Total		50	100.00	30	100.00
iv. Funds and other privileges					
Yes	1	31	62.00	20	66.67

No	0	19	38.00	10	33.33
Total		50	100.00	30	100.00
Resource attainment difficulty Research attainment difficulty refers to difficulty in attaining the fund, research material, raw materials and literature for the purpose of conducting research.					
i. Literature					
Yes	1	18	16.00	13	43.33
No	0	42	84.00	17	56.67
Total		50	100.00	30	100.00
ii. Research materials					
Yes	1	35	70.00	14	46.67
No	0	15	30.00	16	53.33
Total		50	100.00	30	100.00
iii. Raw materials					
Yes	1	33	66.00	13	43.33
No	0	17	34.00	17	56.67
Total		50	100.00	30	100.00
iv. Funds and other privileges					
Yes	1	32	64.00	14	46.67
No	0	18	36.00	16	53.33
Total		50	100.00	30	100.00
Acquaintance support Acquaintance support refers to extent of help the students received from his/her chairman, advisory committee members, peers and non-members, own department and other departments.					
Yes	1	46	92.00	-	-
No	0	4	8.00	-	-
Total		50	100.00	-	-
Publishing difficulty Publishing difficulty in this study refers to the difficulty faced by the students while giving the paper for publishing.					

Yes	1	42	84.00	-	-
No	0	8	16.00	-	-
Total		50	100.00	-	-
Research work environment Research work environment in this study refers to surrounding conditions in which the researchers' work.					
Yes	1	47	94.00	-	-
No	0	3	6.00	-	-
Total		50	100.00	-	-
Researcher satisfaction Researcher's satisfaction refer to short-term attitude resulting from an evaluation of students' educational experience, services and facilities.					
Yes	1	45	90.00	-	-
No	0	5	10.00	-	-
Total		50	100.00	-	-

On perusal of data from table 70, it was revealed that in terms of 'whether various types of resources available or not' about 78.00 per cent and 73.33 per cent of students and teachers respectively perceived that literature required for research were available while remaining 22.00 per cent and 26.67 per cent students and teachers respectively said sufficient literature was not available. About 80.00 per cent and 70.00 per cent of students and teachers respectively agreed that research materials were available meanwhile 20.00 per cent and 30.00 per cent of students and teachers agreed that they were not available respectively. About 66.00 per cent and 70.00 per cent of students and teachers respectively opined that raw materials for research were available while 34.00 per cent and 30.00 per cent of students and teachers respectively opined as not available. In case of funds and other privileges availability, 62.00 per cent and 66.67 per cent of students and teachers respectively agreed upon their availability while 38.00 per cent and 33.33 per cent disagreed.

Regarding the resource attainment difficulty, 84.00 per cent of students did not face any difficulty in obtaining literature and 56.67 per cent teachers opined the same.

About 16.00 per cent of students faced difficulty in attaining literature compared to 43.33 per cent of teachers who believed in the same. About 70.00 per cent of students and 46.67 per cent teachers opined that there was difficulty in attaining research materials while 30.00 per cent students and 53.33 per cent teachers opined no difficulty in attaining the same. In terms of raw material attainment difficulty, 66.00 per cent students and 43.33 per cent teachers had perceived there was difficulty in attaining raw materials while 34.00 per cent and 56.67 per cent of students and teachers respectively did not agree upon so. In case of funds attainment difficulty, 64.00 per cent and 46.67 per cent students and teachers respectively perceived there was difficulty in attaining funds while 36.00 per cent students and 53.33 per cent teachers did not agreed upon the same.

About 92.00 per cent of students professed that they received help and support from their acquaintances while 8.00 per cent had not received any help. Eighty-four per cent students found it was difficult to publish articles similarly 94.00 per cent students perceived that research work environment was workable and about 90.00 per cent students were satisfied with their research work while rest 10.00 per cent were not satisfied.

Table 71: Distribution on extent of availability of resources and research attainment difficulty as perceived by teachers and students

Category	Score	Students n=50		Teachers n=30	
		f	%	f	%
Resource availability					
a) Literature					
Very much available	3	6	15.39	10	45.46
Available	2	18	46.15	10	45.45
Not Much available	1	15	38.46	2	9.09
Total		39	100.00	22	100.00
Score obtained		69		52	
b) Research materials					
Very much available	3	6	15.39	5	23.81

Available	2	17	43.59	15	71.43
Not much available	1	16	41.02	1	4.76
Total		39	100.00	21	100.00
Score obtained		69		46	
c) Raw materials					
Very much available	3	2	6.06	5	23.81
Available	2	13	39.39	15	71.43
Not much available	1	18	54.55	1	4.76
Total		33	100.00	21	100.00
Score obtained		50		46	
d) Funds & other privileges					
Very much available	3	0	00.00	5	25.00
Available	2	17	54.84	10	50.00
Not much available	1	14	45.16	5	25.00
Total		31	100.00	20	100.00
Score obtained		48		30	
Resource attainment difficulty					
i. Literature					
Very difficult	3	2	11.11	1	7.70
Difficult	2	13	72.22	6	46.15
Less difficult	1	3	16.67	6	46.15
Total		18	100.00	13	100.00
Score obtained		35		21	
ii. Research materials					
Very difficult	3	2	5.71	0	00.00
Difficult	2	32	91.43	12	85.72
Less difficult	1	1	2.86	2	14.28
Total		35	100.00	14	100.00
Score obtained		67		26	
iii. Raw materials					
Very difficult	3	2	6.06	0	00.00
Difficult	2	30	90.91	11	84.62
Less difficult	1	1	3.03	2	15.38

Total		33	100.00	13	100.00
Score obtained		65		24	
iv. Funds and other privileges					
Very difficult	3	11	34.36	4	28.57
Difficult	2	21	65.64	8	57.14
Less difficult	1	0	0.00	2	14.29
Total		32	100.00	14	100.00
Score obtained		75		30	

A cursory investigation on table 71, revealed that in terms students' perception towards extent of resources availability among thirty-nine students, 46.15 per cent of students stated there was availability of literature followed by 38.46 per cent opined not much availability and 15.39 per cent agreed on very much availability of literature. Similarly, 43.59 per cent students opined there was availability of research materials followed by 41.02 per cent with not much availability and 15.39 per cent opined very much availability of research materials. Likewise, of thirty-one students 54.84 per cent of students stated there was availability of funds and other privileges followed by 45.16 per cent stated not much availability and no student stated that there was very much availability of funds. In terms of raw materials, among thirty-three students 54.55 per cent students stated there was not much availability of raw materials followed by 45.16 per cent stated availability of the same and 6.06 per cent stated very much availability of raw materials.

Students' perception towards extent of resource attainment difficulty indicated that 72.22 per cent, 91.43 per cent and 90.91 per cent stated that literature, research materials, raw materials and funds were difficult to attain. About 34.36 per cent students said that funds were very much difficult to attain followed by 11.11 per cent for literature, 6.06 per cent for raw materials and 5.71 per cent for research materials. About 16.67 per cent students perceived that there was less difficulty in attaining literature followed by 3.03 per cent for raw materials, 2.86 per cent for research materials and no one perceived as it was less difficult to attain funds.

Results regarding the teachers' perception towards extent of resource availability showed that 71.73 per cent opined that there was availability of both research materials and raw materials followed by 50.00 per cent for funds and 45.45 per cent for literature. About 45.46 per cent perceived there was very much availability in terms of literature followed by 23.81 per cent in both research materials and raw materials respectively and 25.00 per cent for funds. About 25.00 per cent stated that funds were not much available for research followed by 9.09 per cent for literature, 4.76 per cent for both research materials and raw materials respectively.

Extent of resource attainment difficulty as perceived by teachers shows that 85.72 per cent had difficulty in attaining research materials followed by 84.62 per cent for raw materials, 57.16 per cent for funds and 46.15 per cent for literature. About 46.15 per cent teachers perceived that it was less difficult to attain literature followed by 15.38 per cent for raw materials and 14.28 per cent for both research materials and funds. About 28.57 per cent perceived it was very difficult to attain funds followed by 7.70 per cent for literature.

The challenges encountered for obtaining literature could be lack of studies in particular area, registration fee to access scholarly journals and sometimes internet connection. Difficulty in attaining research and raw materials could be because of unavailability of proper lab equipment's or seeds or fertilizers for research. Untimely disbursement of funds for research may result in difficulty to attain raw materials and other privileges.

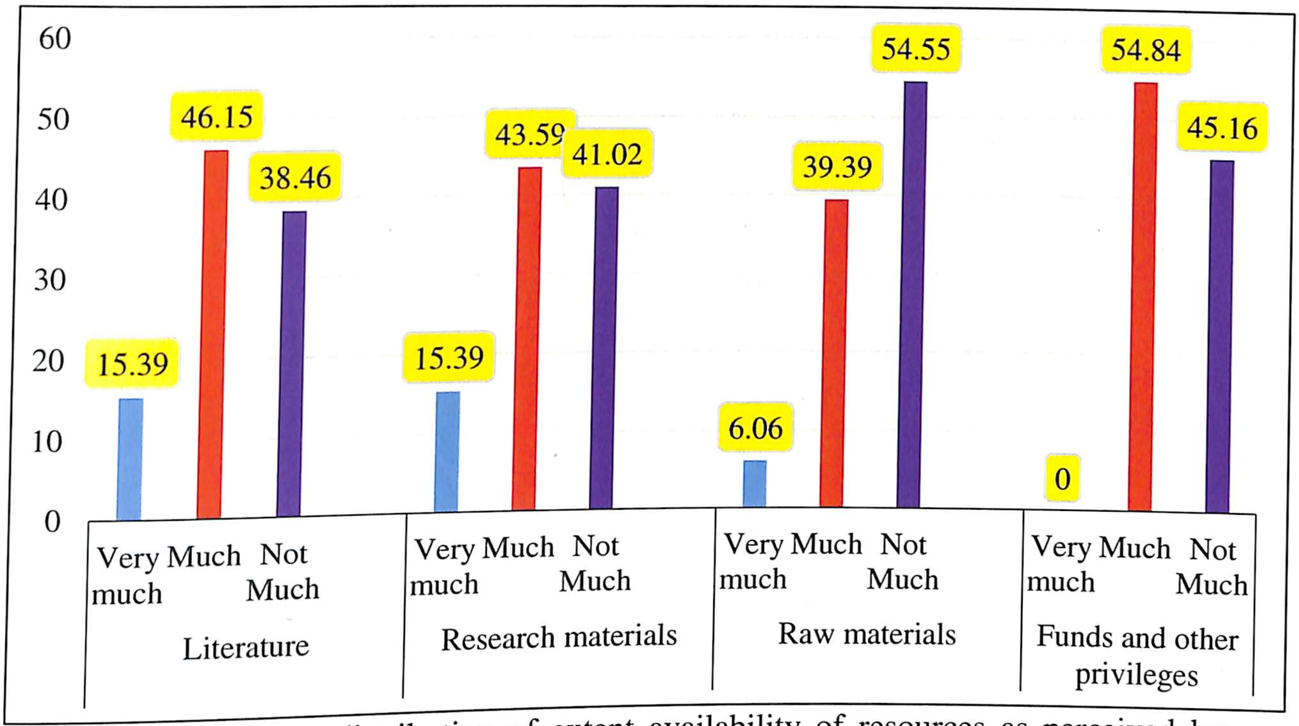


Fig. 61: Percentage distribution of extent availability of resources as perceived by students

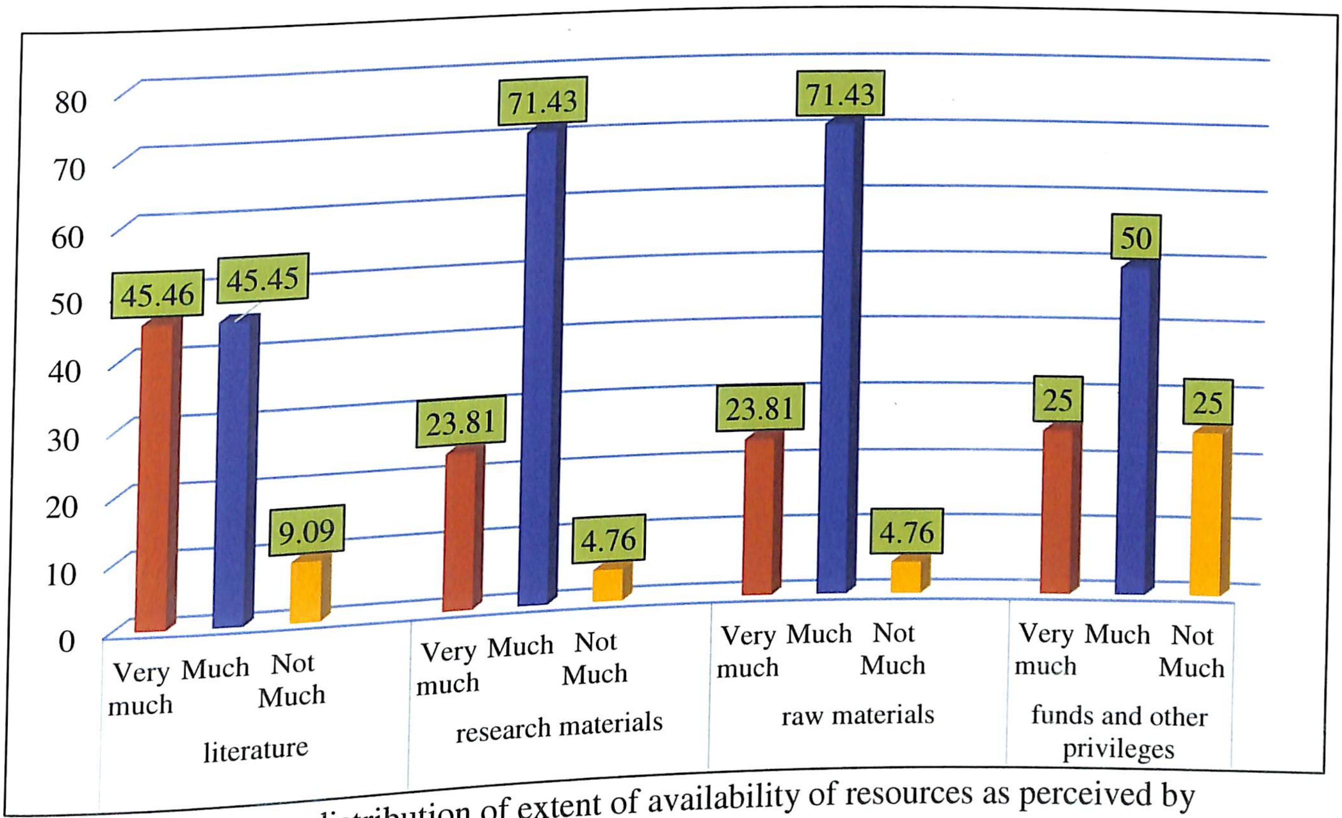


Fig.62: Percentage distribution of extent of availability of resources as perceived by teachers

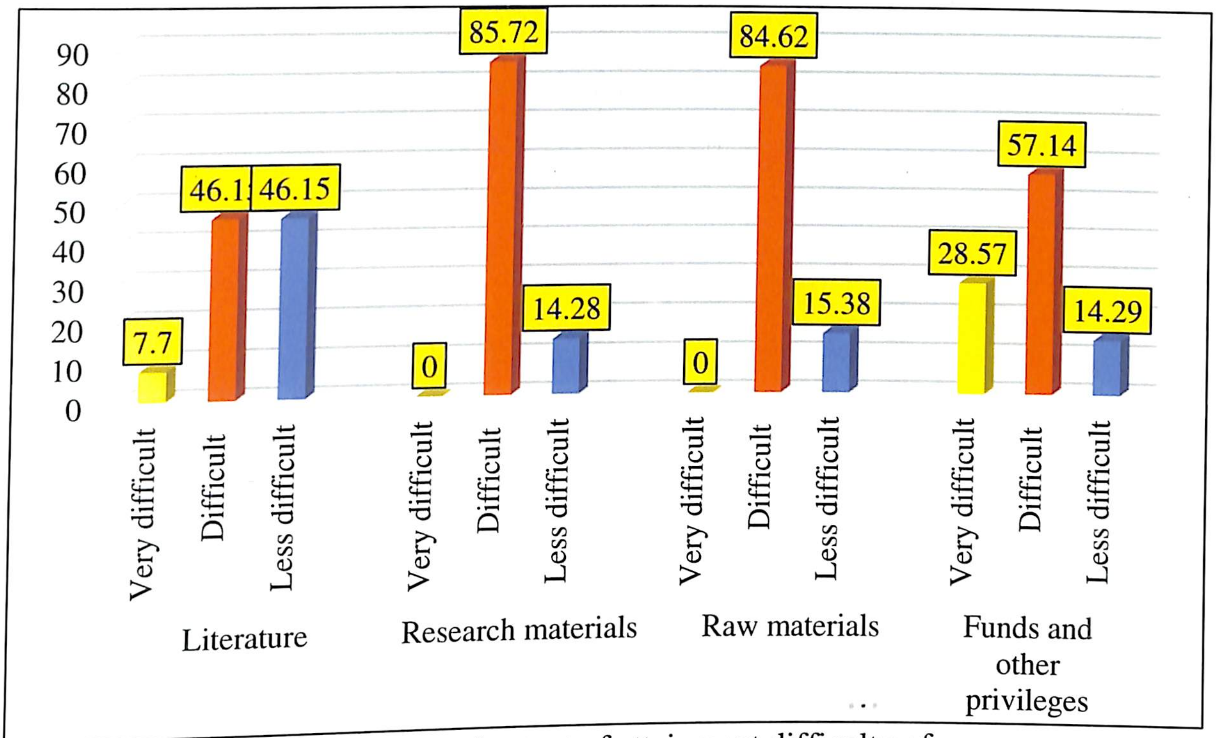


Fig. 63: Percentage distribution of extent of attainment difficulty of resources as perceived by students

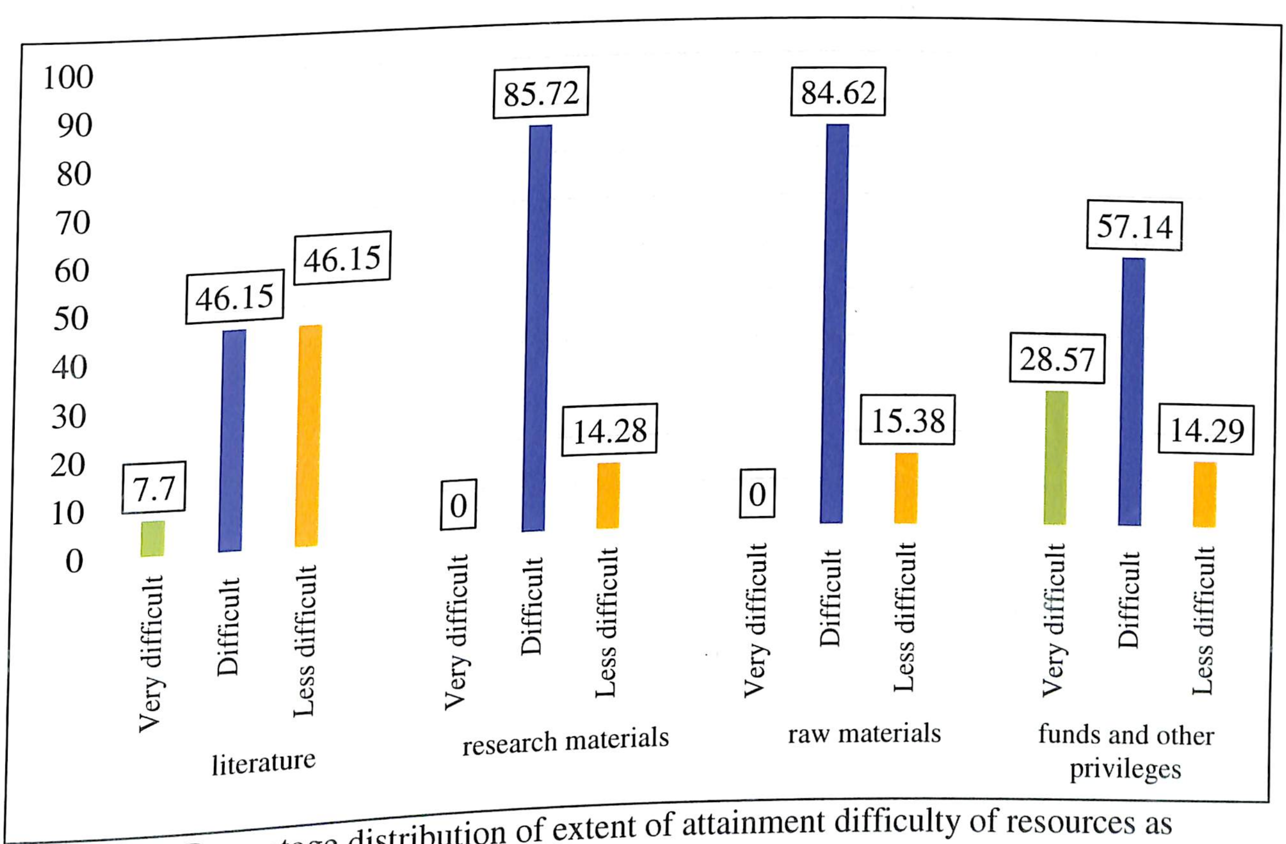


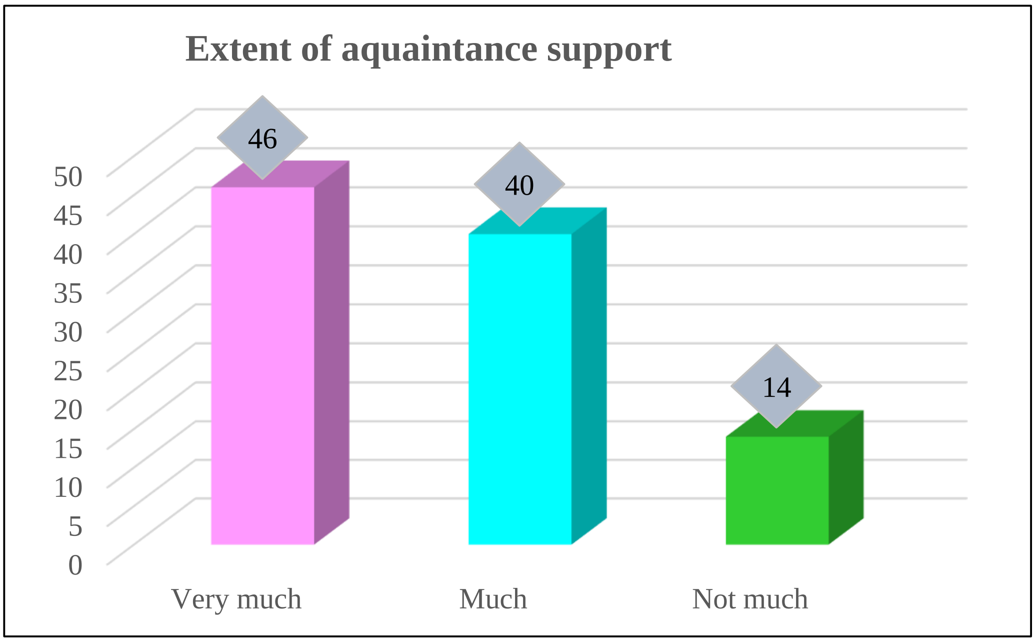
Fig. 64: Percentage distribution of extent of attainment difficulty of resources as perceived by teachers

Table 72: Distribution on extent of acquaintance support, publishing difficulty, research work environment and research satisfaction as perceived by students

Category	Score	Students n=50	
		f	%
Acquaintance support			
a) Friends and peers			
Very much	3	23	46.00
Much	2	20	40.00
Not much	1	7	14.00
Total		50	100.00
Score obtained		112	
b) Chairman			
Very much	3	40	80.00
Much	2	8	16.00
Not much	1	2	4.00
Total		50	100.00
Score obtained		138	
c) Advisory committee members			
Very much	3	14	28.00
Much	2	26	52.00
Not much	1	10	20.00
Total		50	100.00
Score obtained		104	
d) Non- advisory committee members			
Very much	3	7	14.00
Much	2	22	44.00
Not much	1	21	42.00
Total		50	100.00
Score obtained		86	
e) Own department			
Very much	3	30	60.00

Much	2	19	38.00
Not much	1	1	2.00
Total		50	100.00
Score obtained		129	
f) Other department			
Very much	3	3	6.00
Much	2	33	66.00
Not much	1	14	28.00
Total		50	100.00
Score obtained		89	
Publishing difficulty			
Very difficult	3	9	18.00
Difficult	2	21	42.00
Less difficult	1	20	40.00
Total		50	100.00
Score obtained		89	
Research work environment			
Very much	3	5	10.00
Much	2	36	72.00
Not much	1	6	12.00
Total		50	100.00
Score obtained		93	
Research satisfaction			
Very satisfied	3	14	31.11
Satisfied	2	30	66.67
Less satisfied	1	1	2.22
Total		45	100.00
Score obtained		103	
Min. score= 50 , Max. score= 150			

Regarding the acquaintance support, majority (46.00%) of the students expressed that they got very much help from peers, 80.00 per cent from chairman which was on par with findings of Natekar (2013), 28.00 per cent from advisory committee



193Fig. 65: Percentage distribution on extent of acquaintance support to students

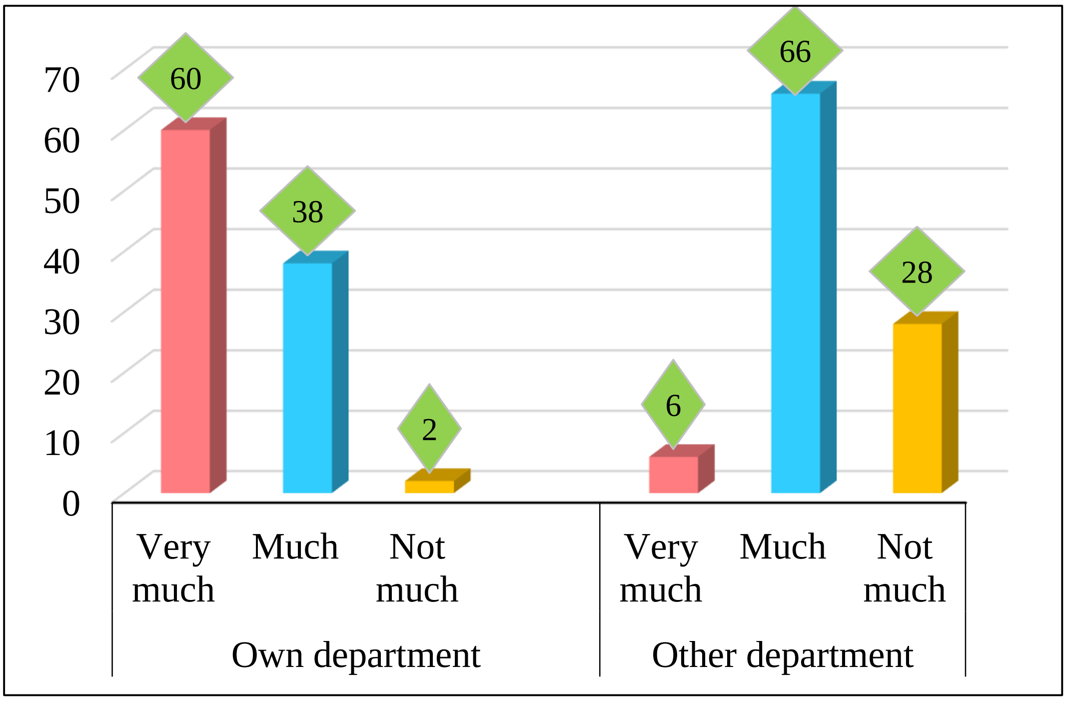


Fig.66: Percentage distribution on extent of contribution from both own and other departments

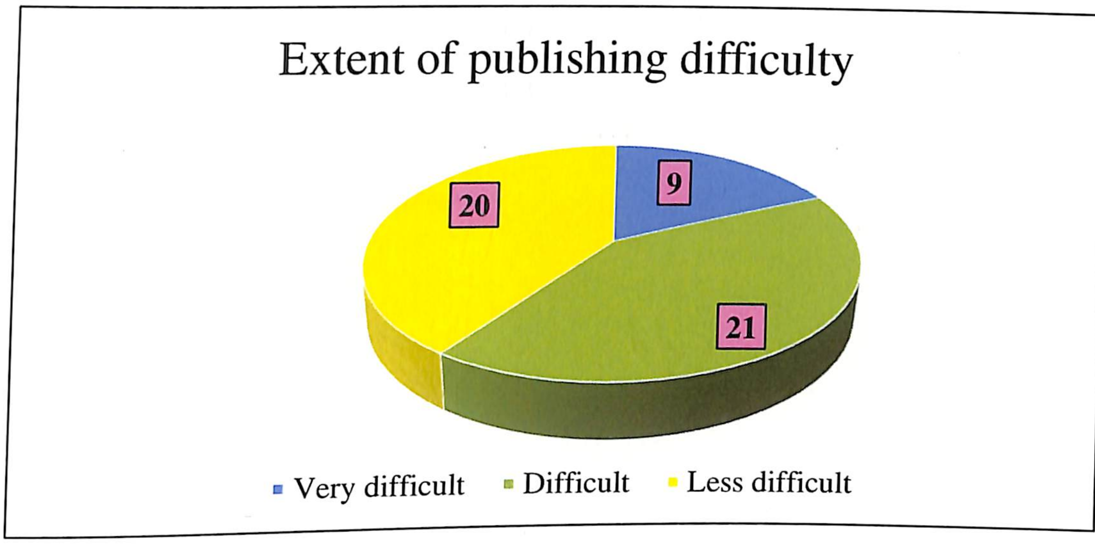


Fig. 67: Percentage distribution on extent of publishing difficulty

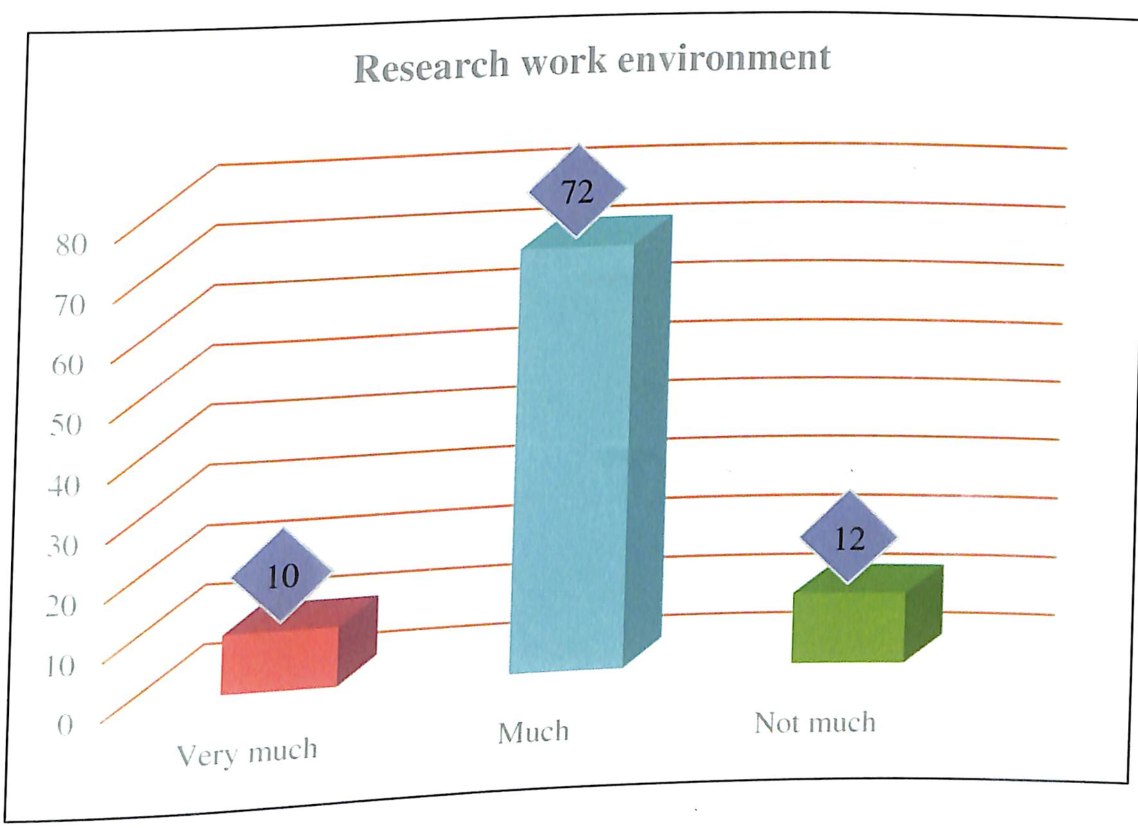


Fig. 68: Percentage distribution based on research work environment

Fig. 69: Percentage distribution on extent of researcher's satisfaction

members and 14.00 per cent from non- advisory members indicating a good relationship. Only 14.00 per cent, 4.00 per cent and 20.00 per cent perceived that they did not receive much support from peers, chairman, advisory members respectively. But 42.00 per cent students perceived they did not get much support from other non-advisory members. In case of contribution from own department, about 60.00 per cent students perceived they had very much support while 38.00 per cent with much support and only 2.00 per cent with not much contribution from own department. Almost 66.00 per cent students felt that there was much contribution from other department followed by 28.00 per cent opined not much contribution and only 6.00 per cent opined very much contribution from other department. With more than half per cent support from own department it will help researcher in completing research work.

Regarding publishing difficulty, it was shown that 42.00 per cent of students faced difficulty in publishing articles whereas 18.00 per cent felt it was very difficult to publish. This can be because of requirements necessary to publish in peer reviewed journals with high impact factor like Elsevier, Springer, Wiley which are unfortunately paid journals and have to undergo a rigorous peer review process which may act as barrier for students in publishing. Sometimes during review process also, they may only publish articles which were found relevant and interesting where subject of research also matters. The whole process can be time consuming.

Regarding the research work environment, almost eighty per cent *i.e.* 72.00 per cent and 10.00 per cent of the students found that research work environment to be much workable to very much workable. When work environment is affected it will directly or indirectly effect behaviour of individual and on how they interact with each other in that environment (Gilmer,1996).

Regarding researcher's satisfaction as seen in table 72 and fig. 69, almost ninety per cent i.e. 66.67 per cent and 31.11 per cent researchers were satisfied to very much satisfied with their research work. This shows that research work is based on their interest and with good support from faculty and advisory committee. This provides positive influence on their mind that helps in future.

4.5.2 Gaps in PhD research themes

Gap in this study was operationally defined as breach between the research themes framed by university and the students and teacher perception about their adequacy regarding those research themes irrespective of the department they belonged are presented in table 73 and 74.

Table 73: Gaps in research themes based on student's perception of adequacy

Sl. No.	Gap	Average weightage	Percentage (%)	Gap %
1	Agronomy	6.00	60.00	40.00
2	Soil science and Agricultural chemistry	7.25	72.50	27.50
3	Pomology and floriculture	6.67	66.70	33.33
4	Plantation and spices	6.50	65.00	35.00
5	Post-harvest technology	6.00	60.00	40.00
6	Vegetable science	7.00	70.00	30.00
7	Agricultural entomology	6.75	67.50	32.50
8	Plant pathology	5.67	56.70	43.30
9	Plant physiology	7.00	70.00	30.00
10	Plant breeding and genetics	6.33	63.30	36.70
11	Plant biotechnology	7.00	70.00	30.00
12	Agricultural economics	8.00	80.00	20.00
13	Agricultural extension	6.80	68.00	32.00
14	Community science	8.00	80.00	20.00
	Overall weightage	6.78	67.80	32.20

On perusal of data from table 73 and fig. 70, indicating student's perception about gap in research themes, it can be inferred that students from two departments *viz.* Agricultural Economics and Community Science were satisfied with 80.00 per cent of research themes while students from Soil Science and Agricultural Chemistry department with 72.50 per cent. Students from departments of Vegetable Science, Plant Physiology and Plant Biotechnology were pleased with 70.00 per cent of research themes. While students from department of Agricultural Extension with 68.00 per cent, department of Agricultural Entomology students with 67.50 per cent, department of Pomology and Floriculture with 66.70 per cent, students from department of Plantation and Spices with 65.00 per cent, department of Plant Breeding and Genetics students with 63.33 per cent whereas students from both department of Agronomy and Post-Harvest Technology were pleased with 60.00 per cent respectively and department of

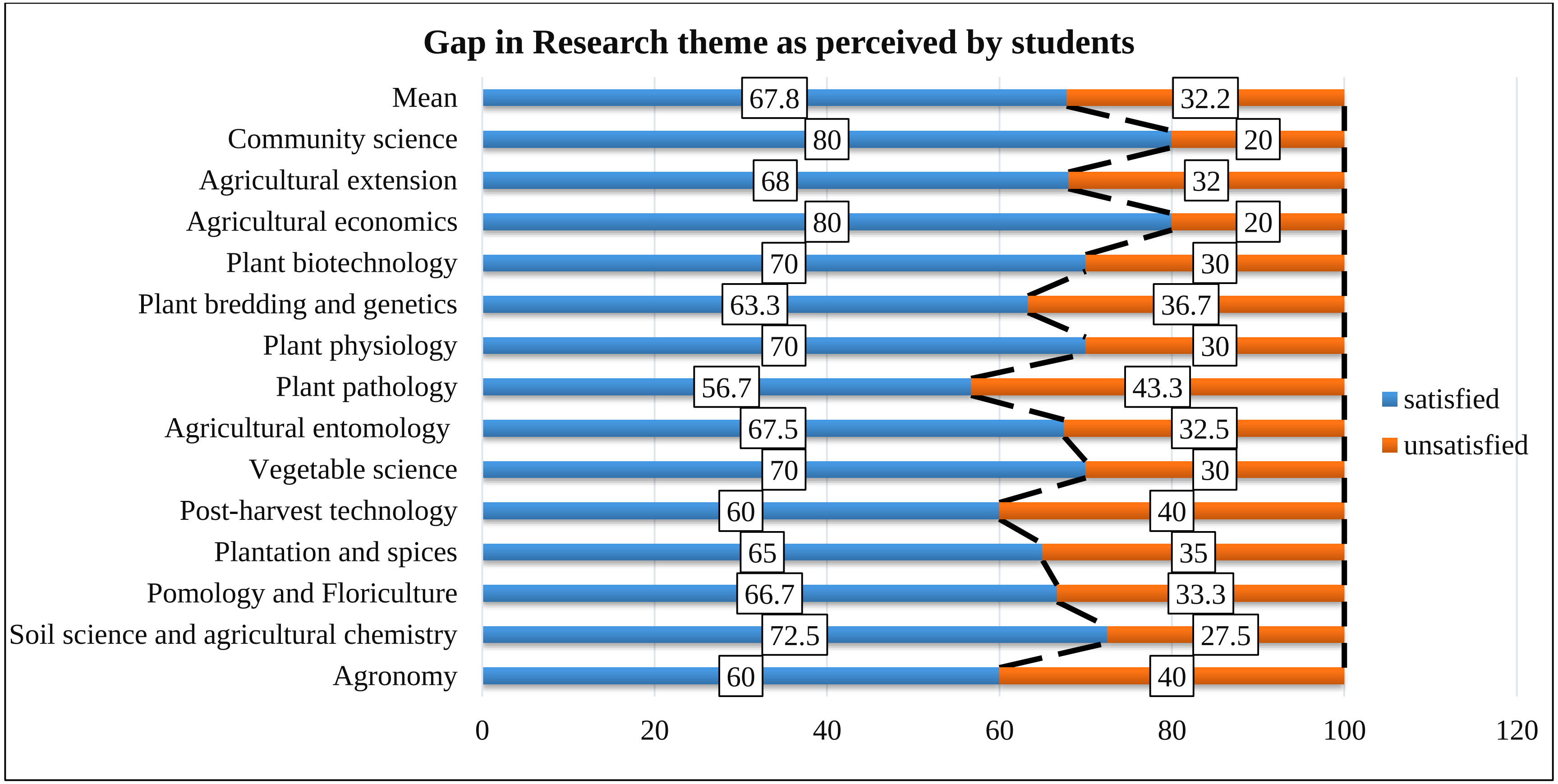


Fig. 70: Percentage distribution based on perception of adequacy of research themes by students

Plant Pathology students were only pleased with 56.7 per cent of research themes. In terms of overall weightage, students were satisfied with 67.80 per cent of research themes framed by the university.

Table 74: Gaps in research themes based on teacher's perception of adequacy

Sl. No.	Gap	Average weightage	Percentage (%)	Gap %
1	Agronomy	8.40	84.00	16.00
2	Soil science and Agricultural chemistry	8.00	80.00	20.00
3	Pomology and floriculture	8.00	80.00	20.00
4	Plantation and spices	6.50	65.00	35.00
5	Post-harvest technology	7.00	70.00	30.00
6	Vegetable science	9.00	90.00	10.00
7	Agricultural entomology	6.80	68.00	32.00
8	Plant pathology	6.50	65.00	35.00
9	Plant physiology	9.00	90.00	10.00
10	Plant breeding and genetics	8.00	80.00	20.00
11	Plant biotechnology	7.00	70.00	30.00
12	Agricultural economics	8.00	80.00	20.00
13	Agricultural extension	7.50	75.00	35.00
14	Community science	7.50	75.00	25.00
	Overall weightage	7.66	76.66	23.40

From the table 74 and fig. 71, it can be interpreted that teachers from department of Vegetable Science and Plant Physiology were satisfied with 90.00 per cent of research themes respectively while teachers from Agronomy department with 84.00 per cent. Teachers from four departments (Soil Science and Agricultural Chemistry, Pomology and Floriculture, Plant Breeding and Genetics and Agricultural Economics) were satisfied with 80.00 per cent of research themes, whereas teachers from Agricultural Extension and Community Science department with 75.00 per cent, Post Harvest Technology and Plant biotechnology department teachers with 70.00 per cent satisfaction, Agricultural Entomology department with 68.00 per cent and teachers from department of Plantation and Spices and Plant Pathology were satisfied with only 65.00 per cent of research themes. Based on overall weightage teachers were contented with 76.6 per cent of research themes formulated by the university.

Even though, this cannot show a clear indication as matter of fact that it was calculated based on small sample size. Even so, from above both tables it can be concluded that based on the students and teachers' perception more than half of the both respondents were pleased with research themes framed by university but the left gap can be filled by omitting the often used or rarely touched themes or by including new thrust areas based on current scenario of need for farmers or on advanced technologies or areas for scope to research.

4.5.3 Ability of students to do research

Ability of students in this study refers to skills they attain for conducting research. The results representing ability of students to do research as perceived by teachers is illustrated in table 75.

Table 75: Distribution of teacher's perception based on students ability to do research

Category	Class limit	f	%
Low (M-SD)	<41	4	13.33
Medium (M±SD)	41-54	22	73.34
High (M-SD)	>54	4	13.33
	Total	30	100.00
Mean= 47.67; SD= 6.76			

On cursory look at table 75 and fig.72, it was noticed that 73.34 per cent of students have moderate ability to do research followed by 13.33 per cent with high ability and low ability to do research respectively. Henceforth, 86.67 per cent of students have moderate ability to high ability to do research according to teachers which indicates students possess good research skills.

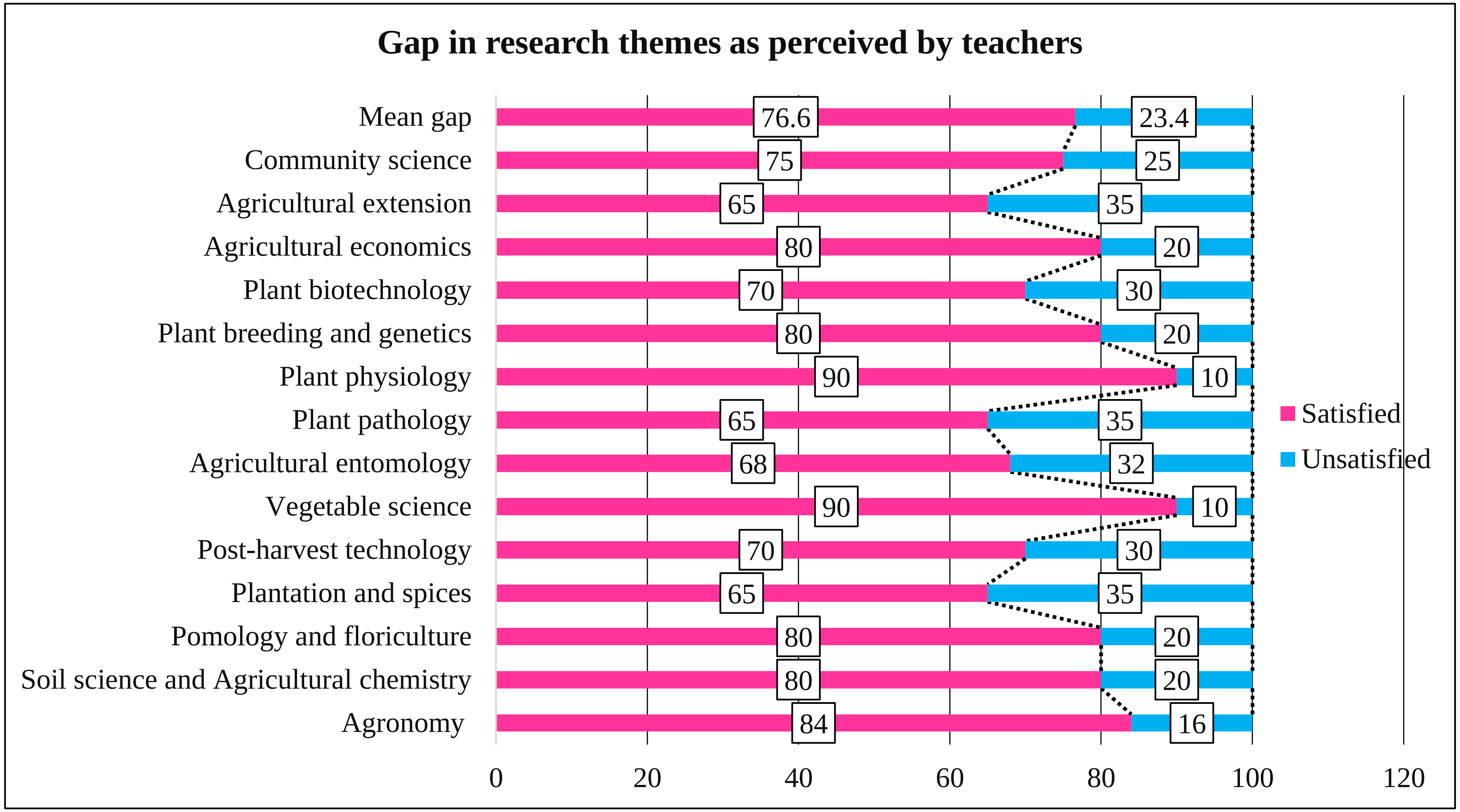


Fig. 71: Percentage distribution based on perception of adequacy of research themes by teachers

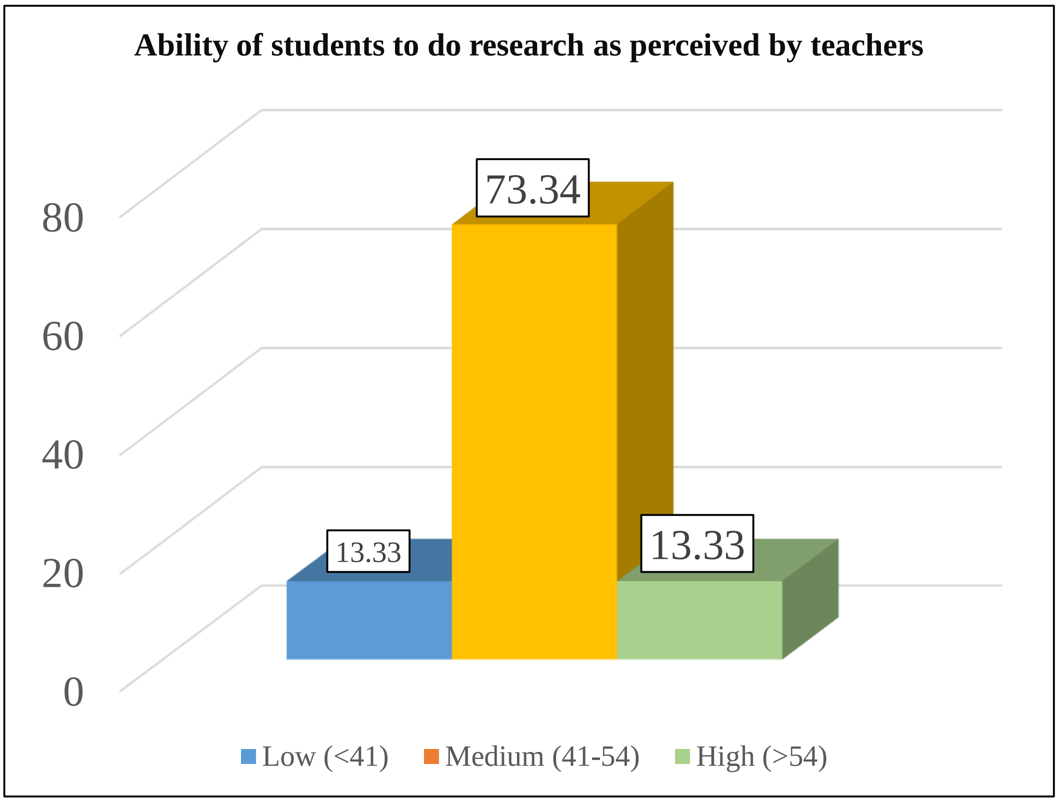


Fig. 72: Percentage distribution based on students ability to do research as perceived by teachers

4.6 ATTITUDE OF PhD STUDENTS TOWARDS RESEARCH

Attitude of students towards doctoral research in this study was operationalised as positive or negative mental predisposition of students towards their research. Attitude of students towards Ph.D. research was recorded and calculated as perceived by both students and teachers.

The results showing overall attitude of students towards research as perceived by students is presented in the table 76 and furthermore correlation between overall attitude of students towards research and some of selected independent attributes in table 77.

Table 76: Distribution of respondents based on overall attitude of students towards research

Category	Class limit	f	%
Low (M-SD)	<67	9	10.00
Medium (M±SD)	67-83	29	74.00
High (M+SD)	>83	12	16.00
	Total	50	100.00
Mean score=75.12, SD=8.75, Min.-Max.= 20-100			

Low-poor attitude, Medium- good attitude, High- very good attitude

By looking at table 76 and fig. 73, it can be reported that majority (74.00 %) of students possessed good attitude towards research followed by 16.00 per cent with very good attitude and only 10.00 per cent showed poor attitude towards research as calculated based on mean score and standard deviation as check. This indicates that almost 90.00 per cent of students had favourable attitude towards research.

The possible reason for this favourable attitude could be because of their familiarity with the research procedure which was experienced at post graduate level. According to Williams & Coles (2003), research experience influences views toward research, with individuals who have done research before forming a more positive influence. Other reasons may include student’s interest in the research area or in improving career prospects for or outside of an academic/research career, sufficient resources availability, opportunity to improve their research skills *etc.* The findings were in line with Seher *et al.* (2018) and Boppana (2019).

It can be inferred from table 77 that independent variables like age, statistical/analytical skills, universal outcomes, raw material availability, funds and other privileges availability and advisory committee support were found not significant in correlation with students' attitude towards research. Hence there was no relationship between them. Meanwhile, other independent variables showed a significant relationship with attitude. Among these variables, non-advisory members support observed to have negatively significant relationship at 5 per cent significance level.

Research work environment was found to be positive and significant at 5 per cent significance level whereas information seeking skills, methodology skill, communication skill, literature availability, research material availability at 10 per cent significance level and problem solving skills of students at one per cent significance level with student's attitude towards research.

Table 77: Correlation between overall attitude of students towards research and selected independent variables

Sl.No.	Independent variable	p value
1	Age	0.178
2	Information seeking skill	0.451**
3	Methodology skill	0.434**
4	Problem solving skill	0.471***
5	Statistical/analytical skills	0.203
6	Communication skills	0.428**
7	Universal outcomes	0.097
8	Literature availability	0.385**
9	Research material availability	0.403**
10	Raw material availability	0.158
11	Funds and other privileges availability	-0.132
12	Research work environment	0.36*
13	Advisory committee support	-0.017
14	Non- advisory members support	-0.294*

* Correlation is significant at 0.05 level (two tailed)

** Correlation is significant at 0.10 level (tow tailed)

*** Correlation is significant at 0.01 level (two tailed)

As observed each attribute wise, it was apparent that students' information seeking skill has positive and highly significant relationship (p=0.451**) with their attitude towards research. This positive relationship can be because of students having access to electronic media where they can browse for any relevant information databases, search for alternatives options to find solutions, availability of library resources with internet access makes it easier for scholars to seek information necessary for research. Methodology skills of students have positive and significant relationship (p=0.434**) with their attitude towards research because researcher's possessing sufficient knowledge and skill in terms of preparing manuscript, abstract with ability to write a comprehensive review of literature. They also have required capabilities in searching, planning and developing research question which further also includes collection of data *via* surveying. There was a positive and significant relationship (p=428**) between scholars' communication skills and their attitude signifying scholars' have enough communication skills and knowledge level in gathering information, tailoring the needs of audiences by questioning, answering and explaining the purpose, objectives and outcomes of research with confidence.

It was apparent from table 77 that there exists a significant and positive relationship (p=385**) in terms of availability of literature and attitude towards research which means that there was an ample literature resource available in the college library in form of journals, magazines, theses, e resources like krishikosh, Online Public Access Catalogue (OPAC), Consortium of e-Resources in Agriculture (CeRA), Science direct *etc.*, services which help students in accessing necessary literature for research that leads to a positive attitude of students towards research. Research material availability had positive and significant correlation (p=403**) with attitude indicating there is an adequate availability of lab equipments, farm equipments and other instruments necessary to conduct experiments that gives a positive influence on their attitude towards research.

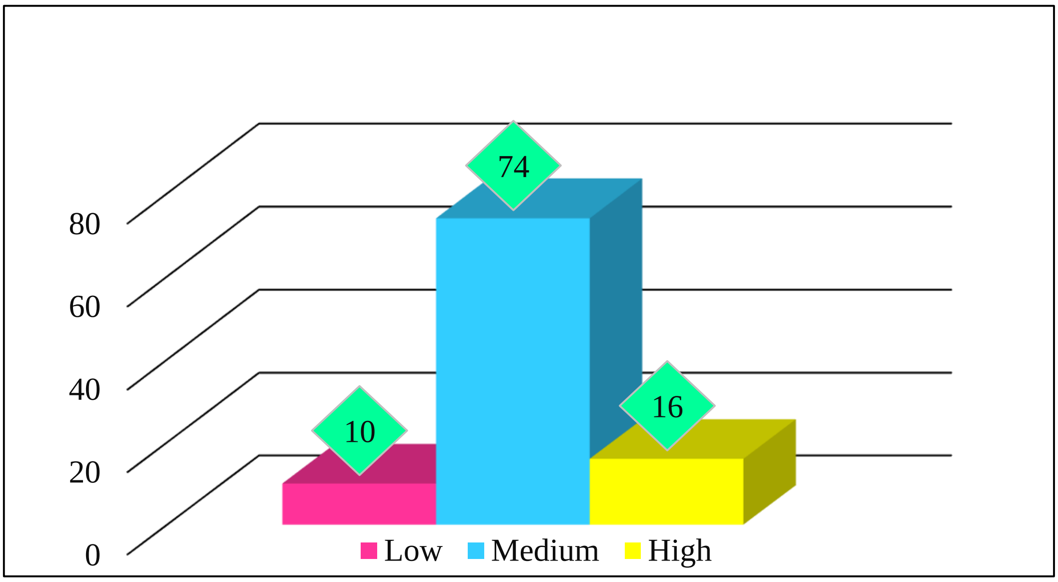
There was a positive and significant correlation (0.471***) between problem solving skills of students and their attitude as students' ability to draw conclusions, take feedback, weighing one solution with other with proper reasoning skills can reflect desirable research outcomes, proves their problem solving skills that reduces their anxiety and discomfort by forming a positive attitude towards research. The positive and significant correlation (p=0.36*) between research work environment and student's attitude towards research represents that if it was not workable, it affects not only the behaviour of an individual researcher but also on how the people in organisation themselves interact (Gilmer, 1966). It influences researcher's performance thereby affecting his attitude towards research. In case of non-advisory committee support and students' attitude towards research there exists a negative and significant correlation (p=294*) which indicates that students required more support from non-advisory committee members which might be in case of some research works because of the similarities present with those members specialisation in certain research area that may help the students in their research work.

The results regarding overall attitude of students towards research as perceived by teachers is presented in table 78.

Table 78: Distribution based on the attitude of students towards research as perceived by teachers

Category	Class limit	f	%
Low (M-SD)	<33	3	10.00
Medium (M±SD)	33-42	23	86.67
High (M+SD)	>42	4	13.33
	Total	30	100.00
	Mean score=33.13, SD= 4.72, Min.- Max. = 10-50		

Scrutinizing table 78 and fig. 74, revealed that 76.67 per cent of students possessed good attitude as perceived by teachers followed by 13.33 per cent teachers perceived students had very good attitude and only 10.00 per cent teachers perceived students had poor attitude towards research. This indicated that almost ninety per cent of teachers opined students had favourable attitude towards research. The reasons for this opinion could be because of doctoral students' experience in research process during their post-graduation or have interest or knowledge in that particular research area or possess adequate research skills to present the outcomes of research that may have convinced the teachers about their favourable attitude towards research.



.

Fig.73: Percentage distribution of students based on their attitude towards research

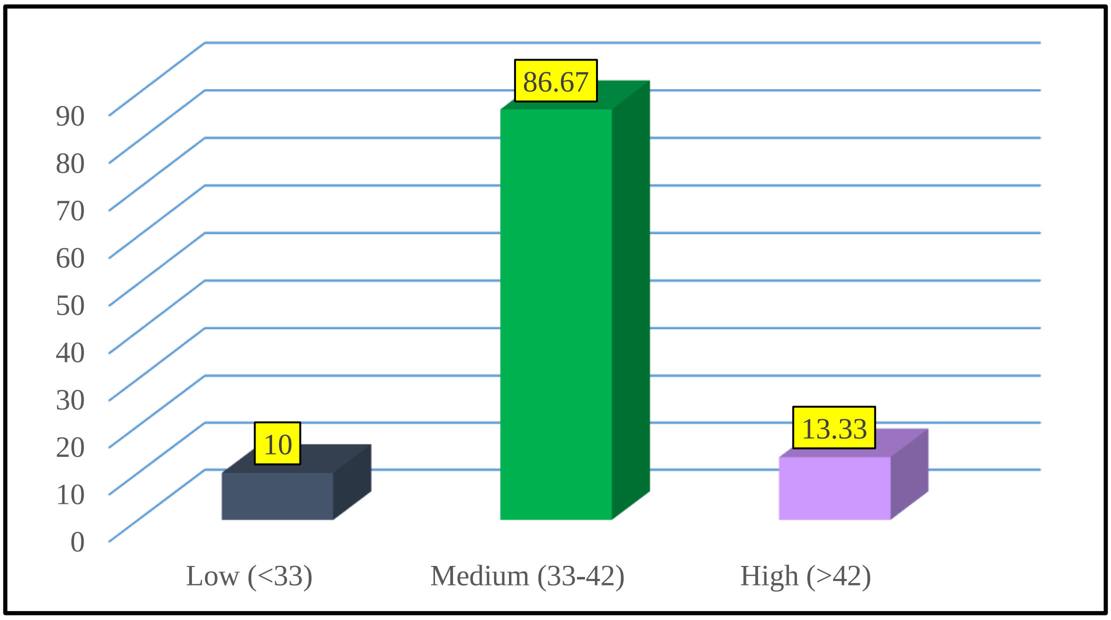


Fig. 74: Percentage distribution based on attitude of students towards research as perceived by teachers

It can be observed from table 79 that independent variables like guiding experience of teachers, number of students guided/guiding previously, number of students guiding and perception of adequacy were found not significant in correlation with teacher's perception of students' attitude towards research. Meanwhile, there was a significant relationship between teacher's perception on student's attitude and ability of students to do research which is positive in correlation (p=0.455*) at five per cent significance level. This positive relationship can be because students possessed enough research skills like in terms of seeking information, planning and conducting research with proper methodology, data collection procedures or solve the research related problems synthetically or creatively and also have ability to present the research outcomes confidently.

Table 79: Correlation between overall attitude of students towards research as perceived by teachers and selected independent variables of teachers

Sl.No.	Independent variables	p value
1	Guiding experience	-0.352
2	Number of students guided/guiding previously	-0.138
3	Number of students currently guiding	-0.008
4	Ability of students to do research	0.455*
5	Perception adequacy	0.198

* Correlation is significant at 0.05 level (two tailed)

4.7 CONSTRAINTS OF PhD RESEARCH

The constraints as perceived by both students and teachers were categorised based on commonality and the ranking were given for each constraint based on percentages. The results are presented in table 80 and 81.

On examining table 80, it was shown that important constraints as perceived by students were lack of sufficient funds for research with 66.00 per cent followed by lack of advanced research facilities and equipments with 48.00 per cent, insufficient lab facilities with 42.00 per cent, shortage of labour with 34.00 per cent, insufficient time for research with 24.00 per cent, constraint in land availability with 20.00 per cent, lack of raw material and literature availability with 18.00 per cent and 16.00 per cent respectively, insufficient scholarship and high cost in engaging labour with 12.00 per cent each, lack of training for students in handling advanced equipments/ techniques and non-cooperative labour staff with 6.00 per cent respectively, followed by conventional research and difficulty in publishing with 4.00 per cent respectively.

Table 80: Distribution of constraints as perceived by students

Sl.No.	Constraints	f	%	Rank
1	Funds	33	66.00	1
2	Advanced research facilities and equipments	24	48.00	2
3	Insufficient lab facilities	21	42.00	3
4	Labour shortage	17	34.00	4
5	Insufficient time for research	11	24.00	5
6	Land constraint in availability	10	20.00	6
7	Raw material availability	9	18.00	7
8	Literature availability	8	16.00	8
9	Insufficient scholarship	6	12.00	9.5
10	High cost in engaging labour	6	12.00	9.5
11	Training in handling advanced equipments/techniques	3	6.00	10.5
12	Non-cooperative labour staff	3	6.00	10.5
13	Conventional research	2	4.00	11.5
14	Publishing difficulty	2	4.00	11.5

On perusal of data from table 81, revealed that major constraints as perceived by teachers were insufficient lab equipments with 53.33 per cent, lack of availability of advanced research facilities with 43.33 per cent, lack of sufficient funds with 40.00 per cent, time limit in completing research with 30.00 per cent, incompetence of students in conducting statistical analysis with 26.67 per cent, lack of focus on research problem with 23.33 per cent, scarcity of labour with 20.00 per cent, many procedural formalities required while conducting research with 16.67 per cent, poor institutional infrastructure and unpredicted climate changes with 13.33 per cent respectively, land area constraint and lack of experience of students in attending seminars or conferences with 10.00 per cent respectively, compartmentalisation of related disciplines and poor scientific temperament of students with 6.67 per cent respectively.

Table 81: Distribution of constraints as perceived by teachers

Sl.No.	Constraints	f	%	Rank
1	Funds	12	40.00	3
2	Advanced research facilities and equipments	13	43.33	2
3	Insufficient Lab equipments	16	53.33	1
4	Poor institutional infrastructure	4	13.33	9.5
5	Labour shortage	6	20.00	7
6	Land area constraint	3	10.00	10.5
7	Lack of focus on research problem	7	23.33	6
8	Compartmentalisation of related disciplines	2	6..67	11.5
9	Many procedural formalities	5	16.67	8
10	Lack of exposure to overseas conferences/seminars	3	10.00	10.5
11	Poor scientific temperament of students	2	6.67	11.5
12	Time limit in research	9	30.00	4
13	Incompetence of students in statistical analysis	8	26.67	5
14	Unpredicted climate changes	4	13.33	9.5

From observing both tables it can be concluded that top three common main constraints as perceived by both students and teachers were lack of sufficient funds, advanced research facilities and insufficient lab equipments. This can be followed by land and labour shortage.

The main reasons for these constraints may be because cost allocation for research is not sufficient in cases of research that has large experiment area or use of high cost equipment that involves more expenditure. With increase in enrolment of research scholars both in PG and PhD research each year it will be hectic in terms of using lab facilities which are deficient to compensate their research work. Lack of advanced research equipments makes researchers compromise quality of their research. Another reason could also be that lack of availability of land for conducting large area of field experiment and also these studies require more labour with high cost in engaging them to work for which allocated fund is not ample to complete their work. In case of doctoral research, field experiment further includes laboratory experiment in most of the cases that further obstructs their research with limited fund and time to complete research. Furthermore, as observed in previous tables supply of inputs, research materials like farm machinery, electricity, seed, fertilizers, pesticides and like were limited or unavailable. Most of the resources for research will be exhausted during initial stages of research itself. Doctoral students do not possess good research skills that sufficiently involves statistical skills and most of the KAU research is not focusing on research problem that involves current needs of farmers and agriculture as opined above.

4.8 SUGGESTIONS FOR IMPROVEMENT

The major approaches for improving doctoral research as perceived by teachers were provision of central instrumentation facilities for lab and other equipments, increasing contingent grants/ funds with timely allotment and encouraging students to participate in externally aided projects. Students should be exposed to learn advance methods or equipment. Enforcement of research collaborations in interdisciplinary or with other organisations/institutes (national/overseas) and students should be given opportunities to participate in seminars/conferences (national or international) which gives them maximum exposure. Improving research skills of students is of utmost important. Preliminary studies should be conducted before doing research. In terms of research system focusing more on untouched thrust areas or innovative technologies like climate resilient agriculture, use of artificial intelligence or robotics in agriculture, genetic engineering, urban agriculture *etc.*, that could give a deliverable output should be encouraged. To improve academic research productivity publishing more quality articles in peer reviewed journals either in national or international with high NAAS rating (6+ impact factor) or based on other similar indices. Increasing number of publications by individual researcher (*i.e.* more than two) which is monitored and reviewed systematically should be fortified.

4.9 HYPOTHESIS OF THE STUDY

1. The content pattern attributes are not appropriate enough to explain the qualitative features of theses submitted by all departments

There were 10 attributes selected for the study, of which 9 variables were similar for all department except one variable fixed only for social science division. This proves that content pattern attributes were appropriate to explain the qualitative features of theses submitted in all departments except one variable. Hence the hypothesis is rejected as all the variables were appropriate in explaining the qualitative features of theses.

2. The academic research productivity parameters are not appropriate enough to explain the qualitative features of theses submitted by all departments

There were 5 attributes selected for studying the proportion published and proportion cited by the theses submitted among all the department. This testifies that academic research productivity attributes are appropriate to explain the quality of publications and thesis based on publications and citation attributes. Hence, the hypothesis is rejected.

3. There exists no difference between attitude of students towards research and selected independent variables as perceived by students

The results from table 77 showed that from selected independent variables research work environment showed positive relationship whereas non- advisory support showed negative relationship with attitude of students towards research at 5 per cent significance level. Other variables like information seeking skills, methodology skills, communication skills, literature availability, research material availability showed significance difference at 10 per cent significance level while problem solving skills showed positive relationship with attitude of students towards research at 1 per cent significance level. Though remaining variables did not show any significant relationship but most of them showed. Hence, null hypothesis is accepted.

4. There exists no difference between attitude of students towards research and selected independent variables as perceived by teachers

The results of table 79 revealed that among the 5 selected independent variables only ability of students to do research showed a significance difference with teacher's perception on student's attitude towards research at 5 per cent significance level. Hence, null hypothesis is accepted.

5. There exists no gap for the future thrust area for PhD research as perceived by KAU teachers in relation to ex-post facto themes covered for last 10 years.

The results from table 74 revealed that on an average the teachers were satisfied with 76.60 per cent of the research themes framed by the university which shows that they were not satisfied with 23.40 per cent of research themes. This testifies that there exists gap for future thrust areas in relation to ex-post facto themes covered for last ten years. Therefore, null hypothesis is rejected.

6.The thrust areas framed by the university for PhD research is fully touched or focused on.

The results from table 9 and table 10 indicated that out of 22 PC groups identified for the period from 2011-2014, 19 PC groups have 80.00 per cent or more untouched areas whereas 14 PC groups out of 17 PC groups from period 2015-2017 found to have more than 80.00 per cent not focused areas. This proves that the thrust areas framed by university under each PC group are not fully focused. Thus, the hypothesis is rejected.

Summary

SUMMARY

Unlike, level of education in under graduation, doctoral education is highly individual in nature with unpredictable path and solely based on idea or hypothesis set for the study. With increase in enrolments of Ph.D. students with each year, emphasises that importance of strengthening the quality of research in various aspects majorly like conducting research, thesis writing, publishing of outcomes and others minor aspects in outcomes of research. Further, with State Agricultural Universities (SAUs) focusing both on education and research providing synergy to multi-disciplinary approach aiming at overall development of agriculture and related institutions it is important to enhance research quality. So, it is necessary to study the components of doctoral research. Hence, this study is vital to assess the content pattern of doctoral research by contributing to farming community with the set forth objectives:

- To assess of research pattern in Ph.D. dissertations
- To assess the productivity of the Ph.D. research in terms of proportion published or cited
- To explore the determinants of Ph.D. students' research efficiency as perceived by the teachers and study the constraints and suggestions as perceived by students and teachers in the conduct of doctoral research

This study was conducted during the academic year 2020-2021 at College of Agriculture, Vellayani. The entire thesis belonging to the eleven departments *viz*. Department of Agronomy, Soil Science and Agricultural Chemistry (SSAC), Horticulture (Vegetable Science, Pomology and Floriculture, Plantation Crops and Spices, Post Harvest Technology), Plant Pathology, Agricultural Entomology, Plant Physiology, Plant Breeding and Genetics (PBG), Plant Biotechnology (PBT), Agricultural Economics, Agricultural Extension and Community Science that have been submitted during period of 2015-2019 were enumerated, categorised under different divisions and subjected to qualitative content analysis.

Apart from identifying trends in PhD research about 'ten' attributes for content pattern and 'five' attributes for academic research productivity were selected for the study. For content pattern crops or areas focused, thrust areas of research, number of

objectives, number of references, references based on years, type of research design, statistical methods used, sample size, types of sampling method and number of independent variables were studied. Academic research productivity was assessed in terms of number of publications, publications in peer reviewed journals, citation distribution based on year, citation distribution based on source, geographic wise distribution of citations and average number of citations per dissertation. Along with these some personal and social characteristics of both students and teachers, attitude of students towards research, other important variables and constraints in conducting doctoral research as perceived by both students and teachers were also studied.

A total of 80 respondents comprising of 50 Ph.D. students who were in second year and third year as on 2020-2021 and 30 teachers who has guided/guiding Ph.D. students were randomly selected for the study. A well-structured pre tested questionnaire was used to collect data from both students and teachers. The findings from the collected data were presented with appropriate statistical analysis.

The salient findings of the study were:

1. A total of 74 theses were submitted during period of 2015-2019 there was an increasing trend in submissions from 2016-2017 which started to decrease in following years.

2. Among them crop production division has maximum number of theses (33) submitted while on the whole maximum (24) theses were submitted during 2017.

3. There was decrease in the percentage of theses submitted for the period from 2016 to 2019 in case of Agronomy and a fluctuating trend among Soil Science and Agricultural Chemistry and Horticulture departments inferring that there was an increasing trend among theses submitted from 2015-2017 and fluctuating trend during 2017-2019 under crop production division.

4. Over different years there was an increase in the percentage of theses submitted for the periods from 2015 to 2019 in case of crop protection theses with maximum number of submissions during 2018.

5. Increase in the percentage of theses submitted for the periods from 2015 to 2017 and decrease in percentage during 2017 to 2018 and it remained same from period 2018 to 2019 in case of crop improvement theses with maximum submissions (8) during 2017.
6. There were no theses submitted from 2016-2019 under Agricultural Economics department and a growing trend was observed under department of Agricultural Extension during period from 2015-2016 followed by no submissions in 2017 that increased in following year which again fallen to no submissions during 2019.
7. In Community Science department, there were no theses submitted during 2016 and 2017 indicating a complete drop from 2015 to 2016 that continued same till 2017 which showed slight increase in trend during 2018-2019.
8. In case of crops or areas focused majority (20.27%) of studies were concentrated on cereals (rice), followed by vegetables (14.87%), fruits (13.51%), and tuber crops (8.11%).
9. An *ex post facto* study of research themes for the study was covered for the period from 2011-2017 which were divided into two periods based on PC groups i.e. from 2011-2014 with 22 PC groups and from 2015-2017 with 17 PC groups.
10. Among 22 PC groups from 2011-2014, 19 PC groups have 80.00 per cent or more untouched areas while most touched area during this period was from Crop Physiology and Biochemistry (CPB).
11. Out of 17 PC groups from period 2015-2017, 14 PC groups were found to have 80.00 per cent or more number of untouched thrust areas with least untouched areas was from Rice (R) with 70.00 per cent.
12. From period 2011-2014 highest number of theses (eight) were recorded from thrust area under Plant Protection (PP) PC group whereas from 2015-2017 highest number (four) was from Rice (R) project coordination group.
13. Summarisation based on number of objectives, showed that majority of the theses (32.43%) had ‘two’ research objectives in their study followed by 28.38 per cent theses with ‘three’ objectives, 21.62 per cent studies with ‘four’ objectives, 6.76 per

cent each with ‘five’ and ‘six’ objectives, 4.05 per cent theses with ‘one’ objective in their research works

14. Among crop production theses, irrespective of departments there existed a medium level (3-4) of objectives with highest percentage (66.67%), followed by low range (18.18%) and high range category with 15.15 per cent.

15. In crop protection division, it was found that highest percentage (75.00%) of theses has medium range of objectives (2-4) followed by high range (>4) with 25.00 per cent and zero studies under low range (<2) category. Likewise, in crop improvement theses 70.00 per cent of studies fell under medium range (2-3) followed by 15.00 per cent each in low (<2) and high (>3) range categories.

16. Social science division showed that all the theses belonged to medium range (2-4) of categories. Under community science division, 82.43 per cent of theses belonged to medium category (2-3) followed by 13.51 per cent under high category (>3) and 4.06 per cent under low category (<2).

17. Irrespective of different departments under crop production, 72.72 per cent of theses have medium number of references followed by 15.15 per cent and 12.12 per cent in high and low category respectively with 122 -464 as minimum to maximum number of references respectively.

18. Majority of crop protection theses regardless of departments were having medium category of references where plant pathology topped the list with 66.66 per cent and followed by Agricultural Entomology with 50.00 per cent.

19. In case of crop improvement division, majority of the theses had medium number of references (85.00%) followed by high number of references (15.00%). One hundred and thirty-nine (139) to four hundred and eighty-nine (489) was the minimum and maximum number of references recorded in Plant Physiology and Plant Breeding and Genetics respectively.

20. In department of Agricultural Economics number of references were two hundred and nine (209). In case of Agricultural Extension, 75.00 per cent of theses had

medium range of references (169-211) followed by 25.00 per cent in low range (<169).

21. Seventy-five per cent of theses in Community Science department were having medium number of references and 25.00 per cent of theses have high number of references.

22. Mean minimum (198) and mean maximum (457) number of references recorded from Social Science and Community Science division respectively but in terms of entire theses it observed that minimum and maximum number of references was 122 and 617 which were recorded from Agronomy and Plant Pathology respectively.

23. More than 50 per cent of references were from publications published after 2000 and infers that researchers referred latest information most for conducting their research.

24. Under crop production division, 40.42 per cent of theses used RBD design followed by 29.79 per cent used CRD, 17.02 per cent used split plot design, 6.38 per cent used factorial-CRD and 4.26 per cent used factorial-RBD.

25. About 47.06 per cent of theses used CRD followed by 35.30 per cent used RBD, 11.76 per cent used factorial CRD and 5.88 per cent of studies did not mention the design used in crop protection division.

26. In case of crop improvement division, 40.91 per cent of research works followed RBD and CRD respectively followed by 18.18 per cent of theses did not mention the design followed in those studies.

27. Fifty per cent of Agricultural Extension theses used exploratory and ex-post facto design respectively whereas Agricultural Economics thesis used ex-post facto design (100.00%) inferring that among the research designs used for the study, majority (60.00%) of social science researches were based on examining past incidents in order to understand a current situation.

28. Fifty per cent of research works under Community Science division followed CRD and ex-post facto design indicating that researches were conducted in laboratory and as survey study respectively.

29. Majority (61.54%) of crop production theses used parametric tests and methods followed by genetics based statistics (13.46 %), basic statistics (9.62%), grouping or clustering type analysis (6.73%), non-parametric tests and methods (3.85%), multivariate analysis (2.88%) and regression analysis (1.92%).

30. Crop protection division indicated that 47.72 per cent theses followed basic statistics followed by parametric tests and methods (34.10%), genetics based statistics (11.36%), non-parametric tests and methods (4.55%) and grouping or clustering type analysis (2.27%).

31. Majority (33.33%) theses of crop improvement used parametric tests and methods then followed by basic statistics (26.23%), genetics based statistics (17.02%), grouping or clustering type of analysis (12.06%), multivariate analysis (4.26%), non-parametric tests and methods (2.84%), regression analysis (2.13%) and 2.13 per cent of theses did not specify the statistical method used.

32. About 59.26 percent researches in social science division used basic statistics followed by 18.51 per cent used parametric tests and methods, 14.81 per cent used multivariate analysis and 7.41 per cent used regression.

33. In Community Science department, majority (35.30%) of the theses used parametric tests and methods followed by non-parametric tests and methods (23.53%), basic statistics (17.65%), regression (11.76%) and multivariate analysis (5.88%).

34. Under crop production division, only Horticulture theses studied with sample size greater than 300. Regardless of various departments, highest percentage (50.00%) of SSAC theses studied with low sample size (1-100) and more than half of theses under agronomy used sample size ranging from 101-200.

35. Crop protection division showed that theses with sample size range 101-200 were accounted with 41.66 per cent inferring as most preferred range followed by 25.00

vper cent with range 1 to 100 and 16.67 per cent with range 201-300 and 301-400 respectively.

36. Overall, 40.00 per cent of theses under crop improvement division fell under sample size category 101-200 followed by 1 to 100 with 35.00 per cent and 201-300 with 10.00 per cent and 15.00 per cent of theses did not specify the sample size taken for the study.

37. Sixty per cent of theses under social science division studied with sample size ranging from 201-300 followed by 20.00 per cent with range 101-200 and 301-400 respectively and none of the theses belonged to range 1 to 100 and 401-500.

38. Overall analysis indicated that most of the theses conducted research using sample size ranging from 101-200 followed by 1-100 with Horticulture theses using highest (>400) sample size in research.

39. Among all the theses, majority (40.00%) used random sampling followed by 28.00 per cent used purposive sampling and multistage sampling respectively and 4.00 per cent used stratified multistage random sampling irrespective of various divisions.

40. In agricultural economics, 14 independent variables were identified. Seventy-five per cent of theses have medium (9-30) number of independent variables in Agricultural Extension followed by 25.00 per cent with more than thirty variables.

41. Out of total 74 research studies, 39.19 per cent works published ‘less than two’ publications followed by 36.49 per cent published ‘two’ papers per research work and 24.32 per cent studies published ‘more than two’ papers.

42. More publications were reported to be ‘less than two’ from crop protection, crop improvement and social science division whereas under crop production division at least two publications were published from majority (42.42%) of research works and community science theses published more than two publications at least.

43. Out of 165 publications, majority (82.42%) of publications were published in NAAS rated journals followed by Google Scholar (12.12%), Copernicus index and

other measurements (2.42%) respectively, UGC-CARE list (1.21%) and Scopus index (0.61%).

44. Maximum number of citations *i.e.* 84.05 per cent were from period after 1990 followed by period from 1961-1990 (13.46%), 2.04 per cent for period 1931-1960, 0.37 per cent citations for period 1900-1930 and for period before 1900 which accounts for 0.08 per cent citations.

45. In crop production division, most cited source was journals (73.28%) followed by books, M.Sc. theses, Ph.D. theses, proceedings, compiled books, e-resources, government publications, technical bulletin or series and abstracts.

46. Among crop protection theses, journals were cited most with 77.43 per cent followed by books (5.92%), M.Sc. theses (3.88%), proceedings (2.65%), Ph.D. theses (2.13%), e-resources (1.87%), compiled books (1.79%), technical bulletin or series (0.67%) then annual report (0.58%) and abstract (0.52%).

47. Journals were cited in highest number followed by books, M.Sc. theses, compiled books, proceedings, Ph.D. theses, e-resources, government publications, abstracts and newsletter under crop improvement division.

48. Journals were the most cited source of publications in social science department with 50.16 per cent citations followed by books, e-resources, M.Sc. theses, Ph.D. theses, government publications, proceedings, compiled books, working paper and technical bulletin or series.

49. Among theses in Community Science department, majority (72.85%) of citations belonged from journals followed by books (9.40%), M.Sc. theses (4.93%), Ph.D. theses (3.08%), government publications (1.78%), report (1.14%), other publications (0.79%), proceedings and working paper with 0.55 per cent respectively.

50. In crop production theses average number of citations under national publications was 129 whereas 220 from international publications from Agronomy department. Furthermore, among Soil Science and Agricultural Chemistry theses 149 and 244 was the average number of citations under national and international publications

respectively whereas 187 and 272 from national and international publications respectively in Horticulture department.

51. Under crop protection division, average number of citations from national and international publications was 157 and 302 respectively in Plant Pathology department and in Agricultural Entomology theses 113 and 195 citations was the average number of national and international publications respectively.

52. In Crop improvement division, average number of citations in Plant Physiology theses was 128 and 275 from national and international publications respectively. Plant Breeding and Genetics department theses showed average number of citations was 195 and 250 whereas 129 and 353 in Plant Biotechnology department theses for national and international publications respectively.

53. Under social science division, number of citations from national and international publications was 123 and 275 in Agricultural Economics department. In Agricultural Extension department, average number of citations from national publications was 141 and 131 from international publications.

54. In case of Community Science department, average number of citations under national publications was 217 whereas 416 under international publications.

55. An overall average number of ‘404’ citations were cited among all theses irrespective of departments. With a range of ‘652’ lowest (191) number of citations were from an Agricultural Entomology department thesis while highest number (843) is recorded from a Plant Breeding and Genetics department thesis.

56. Forty per cent of the students fell under mean category (27) of age where 30.00 per cent fell under above mean (≥28) and below mean (≤26) category respectively. The minimum and maximum age was 26 and 28 years respectively.

57. About 82.00 per cent of respondents were female while only 18.00 per cent were male.

58. Majority (50.00%) of the students belonged from village followed by 34.00 per cent from town and 16.00 per cent from city concluding that half of the respondents come from rural area.

59. Forty per cent of students studied in government school up to tenth class followed by 36.00 per cent in aided private school and 24 per cent in unaided private school. Their medium of instruction was mostly in English (72%) and vernacular medium with 28.00 per cent.

60. About 96.00 per cent of students completed their under graduation from government college and only 4.00 per cent from aided private colleges. All students did their master degree from government institutions only.

61. Eighty-two per cent of respondents perceived their parental annual income to be less than 5.4 lakhs with mean as check and only 18.00 per cent of students perceived it to be more than 5.4 lakhs.

62. Information seeking skills of respondents showed that they were confident in searching the information quickly and accurately from journals, books, papers *etc.*, but failed to understand and/or evaluate the accurateness of content and arrange them systematically using their own words.

63. In case of methodology skills respondents possessed the ability to prepare a review of literature, manuscript, abstract *etc.*, but lack proper assertiveness in interpreting and drawing inferences or lack skill in designing experiment study or developing an appropriate instrument.

64. Students were poised in problem solving skills in terms of analysing and taking feedback to reflect them on research outcomes but they seemed having little difficulty in applying scientific methods and finalising research topic or problem logically and relevantly.

65. Statistical skills of students showed their ability in preparing excel sheets, analysing, interpreting and presenting measurements as data sets with illustrations, graphs, tables *etc.,* but were less assertive in terms of constructing hypotheses and analysing significance of test with proper statistical tests and methods required for research conclusions.

66. Communication skills of students showed they were able to communicate with particular audiences in terms of their needs by asking questions and also explaining

purpose, objectives and conclusions of their research yet they showed least confidence in writing article for high refereed journals.

67. In general students were more poised in determining sample size and selecting appropriate research design by actively participating in creation but lack the ability to think creatively or synthetically while making decisions during research work.

68. About 33.33 per cent of respondents belonged to all the age groups 43-47, 48-52 and greater than 53 respectively inferring that all teachers were above forty years in age.

69. About 83.33 per cent of the teachers were female and only 16.67 per cent were male.

70. All the respondents were qualified with doctoral degree. Among them who completed their PhD in KAU were 83.33 per cent and 16.67 per cent from other university.

71. Guidance experience showed that 76.67 per cent of the teachers guided for more than 15 years followed by 60.00 per cent of teachers with five to fifteen years of experience and 16.67 per cent of teachers had less than 5 years of experience.

72. Majority (70.00%) of the teachers had guided/guiding single Ph.D. student previously followed by 16.67 per cent with two students, 10.00 per cent with three students and 3.33 per cent have guided/guiding four or more than four students previously.

73. About 46.67 per cent teachers are currently guiding three students followed by 26.67 per cent guiding only one student and 13.33 per cent teachers guiding two and four students respectively.

74. A total of 126 projects on an average four projects were undertaken per teacher which explains their ability to conduct research and guide students for doctoral research.

75. Under the guidance of 26.67 per cent of teachers their students published two papers followed by 20.00 per cent with more than four papers, 10.00 per cent with one paper and three papers respectively and 6.67 per cent with four papers.

76. More than 75.00 per cent of students perceived that literature, research materials were available while more than 60.00 per cent told raw materials and funds were available.

77. More than 65.00 per cent of teachers opined that all resources (literature, research materials, raw materials and funds) were available.

78. In case of resources attainment difficulty, more than 65.00 per cent of students did not face any difficulty in attaining literature, research materials and raw material while 36.00 per cent opined there was no difficulty in attaining funds for research.

79. More than half of the teachers opined that literature, research materials and funds were not difficult to obtain while 43.33 per cent opined no difficulty in attaining raw materials.

80. About 92.00 per cent of students professed that they received help and support from their acquaintances while 8.00 per cent received no help.

81. Eighty-four per cent of students found it was difficult to publish articles in journals.

82. Ninety-four per cent students perceived that research work environment was workable about 90.00 per cent students were satisfied with their research work while rest 10.00 per cent were not satisfied.

83. Based on the students and teachers' perception more than half of the both respondents were pleased with research themes framed by university.

84. More than eighty-five per cent of students have moderate ability to high ability to do research according to teachers which indicates students possess good research skills.

85. Majority (74.00 %) of students possessed good attitude towards research followed by 16.00 per cent with very good attitude and only 10.00 per cent showed poor

attitude towards research as calculated based on mean score and standard deviation as check.

86. About 76.67 per cent of students possessed good attitude as perceived by teachers followed by 13.33 per cent perceived students had very good attitude and only 10.00 per cent teachers perceived students had poor attitude towards research.

87. Top three common main constraints as perceived by both students and teachers were lack of sufficient funds, advanced research facilities and insufficient lab equipments. This can be followed by land and labour shortage.

Suggestions for future research

The suggestions for future study are:

1. Study on content analysis should be conducted in other colleges in order to get a vivid picture of doctoral research at different agricultural colleges present in Kerala to study the pattern of research.

2. A comparison analysis can be done based on content analysis or academic research productivity of colleges from similar universities to address the differences and similarities between them and help in strengthening doctoral research in KAU.

3. Study on different parameters of academic research productivity that effect quality of doctoral research will also be helpful to understand the actual areas that need to be focused upon academically or at research level.

References

REFERENCES

Aboagye, E., Jensen, I., Bergström, G., Brämberg, E. B., Pico-Espinosa, O. J., and Björklund, C. 2021. Investigating the association between publication performance and the work environment of university research academics: A systematic review. *Scientometrics*, 126(4):3283–3301. Available at: https://doi.org/10.1007/s11192-020-03820-y

Abdel-Ghony, M. 1982. Research productivity and salaries of academic home economists. *J. Home Econ. Res*.11:119-122.

Abramo, G., and D'Angelo, C. A. 2014. How do you define and measure research productivity? *Scientometrics*. 101(2):1129–1144. Available at: https://doi.org/10.1007/s11192-014-1269-8

Abun, D., Magallanes, T., Encarnacion, M., and Lalaine, S. 2019. The attitude of graduate students toward research and their intention to conduct research in the future. *Int. J. Mod. Res. Engg. Mang.* 2(11):74-87.

Aithal, S. 2017. Comparative study of various research indices used to measure quality of research publications. *Int. J. Adv. Sci. Res.* 2:81–89. Available at: https://doi.org/10.5281/zenodo.569763

Akareem, H. S. and Hossain, S. S. 2016. Determinants of education quality: what makes students' perception different. *Open Rev. Educ. Res*. 3(1): 52-67.

Aksnes, D., Langfeldt, L., and Wouters, P. 2019. Citations, citation indicators, and research quality: an overview of basic concepts and theories. *SAGE Open*, *9*:1-7. Available at: https://doi.org/10.1177/2158244019829575

Ali, A. and Ahmad, I. 2011. Key factors for determining students satisfaction in distance learning courses: A study of Allama Iqbal Open University. *Contemp. Educ. Technol.* 2(2):118-134.

Altbach, P. G. 2015. What counts for academic productivity in research universities? *Int. High. Educ.* 79: 6–7. Available at: https://doi.org/10.6017/ihe.2015.79.5837

Alzahrani, J. 2011. Overcoming barriers to improve research productivity in Saudi Arabia. *Int. J. Bus. Soc. 2*: 50–57.

Apurva, S. 2016. Agricultural research in India. [on-line]. Available at: https://www.yourarticlelibrary.com/agriculture/agricultural-research/agricultural-research-in-india/89055 [18 Nov 2021].

Ardeshana, V. R. 1990. Teachers attitude towards teaching at the college of agriculture, Junagadh. M.Sc. (Ag) thesis, Gujarat Agricultural University. Anand, 109p.

Banateppanvar, K., Biradar, B. S., and Kannappanavar, B. U. 2013. Citation analysis of doctoral theses in botany submitted to Kuvempu University, India: A case study. *Collection Building*, 32. Available at: https://doi.org/10.1108/01604951311295058

Banchariya, S. 2019. UGC to assess quality of PhDs awarded in the last decade (online). The Times of India. Retrieved March 3, 2020.

Barczynski, B. and Rek, M. 2011. Evaluation in science—Index Copernicus case study of multi-parametric evaluation system. *Arch. Budo*, *7*: 93–103.

Barrett, A. 2005. The information-seeking habits of graduate student researchers in the Humanities. *J. Acad. Librariansh*. *31*(4): 324–331. Available at: https://doi.org/10.1016/J.ACALIB.2005.04.005

Belavy, D. L., Owen, P. J., and Livingston, P. M. 2020. Do successful PhD outcomes reflect the research environment rather than academic ability? *Plos One*, *15*(8): 1-14. Available at: https://doi.org/10.1371/journal.pone.0236327

Bishwapati, M., Lyngdoh, N., and Challam, T. 2012. A comparative analysis of NAAS ratings of 2007 and 2010 for Indian journals. *Curr. Sci.*, 102(1):10–12.

Biswas, N. 2009. Researches in extension education B. H. U- a content analysis. M.Sc. (Ag) thesis, Banaras Hindu University, Varanasi, 102p.

Boppana, J. 2019. Attitude of postgraduate students towards research. *Guj. J. Ext. Edu.* 30(1):87-89.

Borthakur, A. and Singh, P. 2012. Agricultural research in India: An exploratory study. *Int. J. Social Sc. Interdisciplinary Res.*, 1(9):59-74.

Brew, A. and Boud, D. 2009. Understanding academics' engagement with research. In: A. Brew, and L. Lucas (Eds.), *Academic Research and Researchers Maidenhead*, UK: McGraw Hill, Society for Research into Higher Education (SRHE) and the Open University Press. pp.189-203.

Chatterjea, A. and Moulik, S. 2006. Doctoral education and academic research (in India). *Working Papers*. Paper No. 65. Available at: http://digitalcommons.ilr.cornell.edu/workingpapers/65

Cochrane, L. and Adem, T. 2017. Knowledge gaps and opportunities for future research on Ethiopian food security and agriculture. *Ethiop. J. Appl. Sci. Technol*.8(2): 33-41.

Crewe, I. 1988. Reputation, research, reality: The publication records of UK departments of politics 1978–1984. *Scientometrics*, 14(3–4), 235–250.

Datt, S. and Chetty, P. 2016. 8-step procedure to conduct qualitative content analysis in a research. [online] Project Guru. Available at: https://www.projectguru.in/qualitative-content-analysis-research/

[15 December 2021].

Dkhar, D. 2019. Perceived usefulness and content analysis of post graduate theses in agriculture: The case study of college of Agriculture, Vellayani. M.Sc. (Ag) Thesis. Kerala Agricultural University, Kerala. 340p.

Dkhar, D., and Thomas, A. 2019. Content pattern analysis of selected parameters in social science post-graduate theses. *J. Ext. Educ. 31*(2):6288.

Doraswamy, M. and Pullareddy, V. 2002. Citation analysis of Ph.D. theses in Geography. *University News*. 39: 3-7.

Downe-Wamboldt, B. 1992. Content analysis: Method, applications, and issues. *Health Care for Women Int. 13*(3): 313–321. Available at: https://doi.org/10.1080/07399339209516006

Drake, J. 2011. The role of academic advising in student retention and persistence. *About Campus.* 16:3. Available at: https://doi.org/10.1002/abc.20062

Dundar, H. and Lewis, D. R. 1998. Determinants of research productivity in higher education. *Res. High. Educ. 39*(6): 607–631. Available at: https://doi.org/10.1023/A:1018705823763

Dyer, J., Wittler, H. P., and Washburn, S. 2003. Structuring agricultural education research using conceptual and theoretical frameworks. *J. Agric. Educ.* 44(2): 61-74 Available at: https://doi.org/10.5032/jae.2003.02061

Edgar, L. D. 2007. A 10 - year content analysis to assess research theme areas in agricultural education: Gap analysis of future research priorities in the discipline. Ph.D. thesis. Texas A and M University, Texas. 157p.

Falk, L. L., Augustin, H., Torén, K., and Magnusson, M. 2019. Doctoral students' perceived working environment, obstacles and opportunities at a Swedish medical faculty: A qualitative study. *BMC Med. Educ.*, *19*(1): 250. Available at: https://doi.org/10.1186/s12909-019-1684-x

Fidzani, B. T. 1998. Information needs and information-seeking behavior of graduate students at the University of Botswana. *Libr. Rev.* 47(7): 329 – 344.

Fox, M. F. 1983. Publication productivity among scientists: A critical review. *Soc. Stud. Sci.*13: 285-305.

Fox, M. F. 1992. Research productivity and the environmental context. In: T. G. Whiston and R. L. Geiger (Eds.), *Research and Higher Education: The United Kingdom and the United States*. Buckingham England: The Society for Research into Higher Education (SRHE) and Open University Press. pp. 103–111.

Franestian, I., Suyanta, and Wiyono, A. 2020. Analysis problem solving skills of student in junior high school. *J. Phys. Conf. Ser.* 1440(1): 012089. Available at: https://doi.org/10.1088/1742-6596/1440/1/012089

Ghulami, H. R., Hamid, M. R. and Zakaria, R. 2015. Students' attitudes towards learning statistics. In: *International Conference on Mathematics, Engineering and Industrial Applications. AIP Conference Proceedings.* 28–30 May 2014. Penang, Malaysia, 1660(1): 050035. Available at: http://dx.doi.org/10.1063/1.4915668

Gilmer, B. V. 1966. *Industrial Psychology.* McGraw Hill, New York, 513p.

Gilmore, J. and Feldon, D. 2010. Measuring graduate students' teaching and research skills through self-report: Descriptive findings and validity evidence. In: *Annual Meeting of the American Educational Research Association*, Denver, Colorado, April 30-May 4, 2010.

Glocker, D. 2011. The effect of student aid on the duration of study. *Econ. Educ. Rev. 30*(1): 177–190. Available at: https://doi.org/10.1016/j.econedurev.2010.08.005

Gruszczynska, A. 2016. 10 common challenges faced by early career researchers. Wiley [on-line]. Available at: https://www.wiley.com/network/researchers/writing-and-conducting-research/10-common-challenges-faced-by-early-career-researchers [24 November 2021].

Hesli, V. L. and Lee, J. M. 2011. Faculty research productivity: Why do some of our colleagues publish more than others? *Political Sci. Politics*, 44(2):393–408. Available at: https://doi.org/10.1017/S1049096511000242

Hiremath, R. and Sangen, S. L. 1988. A citation analysis of doctoral dissertations in Chemistry. In: *SIS Annual Conference of Scientific communication in Bibliometrics and Informetrics.* Council of Scientific and Industrial Research–Indian Institute of Chemical Biology (CSIR–IICB), Calcutta.

Holland, C., Westwood, C., and Hanif, N. 2020. Underestimating the Relationship Between Academic Advising and Attainment: A Case Study in Practice *Front. Educ. 5*. Available at: https://www.frontiersin.org/article/10.3389/feduc.2020.00145

Husemann, M., Rogers, R., Meyer, S. and Habel, J. C. 2017. Publicationism and scientists satisfaction depend on gender, career stage and the wider academic system. *Palgrave Commun*. 3(1): 1-10.

Imoro, O., Alemna, A., and Kumah, M. 2018. Analysis of doctoral thesis citation patterns: a case study of the Sam Jonah Library, Ghana. *Libr. Phil. Pract.* [e-journal]. ISSN 1522-0222. Available at: https://digitalcommons.unl.edu/libphilprac/1692 [4 December 2021].

Jalihal, K. A. 1970. A study of the concept and role of agricultural universities in India. *J. Educ. Res. Ext.* 12 (2):83-87.

James, R. 2009. Evaluating teaching innovation. CSHE, short notes [21 November, 2021].

Johnson, B. 2000. Environmental impact: A preliminary citation analysis of local faculty in a new academic program in environmental and human health applied to collection development in an academic library. *Libr. Philos. Pract.* 2 (2): 44- 47. Available: http://unllib.unl.edu/LPP/johnson.html

Karadag, E. 2010. An analysis of research methods and statistical techniques used by doctoral dissertation at the education sciences in Turkey. *Curr. Issues Educ. 13(4)*:1-20.

KAU [Kerala Agricultural University]. n.d. Overview of research in KAU. [on-line]. Available at: https://kau.in/basic-page/overview-research-kau [15 Nov 2021].

Khodadoost, M., Heidarinejad, S., Ebadi, G., Mehdipoor, A., and Bashbarat, Z. D. 2011. A survey of content analysis of M.Sc. thesis: descriptive characteristics and norms of ISO 9002 for writing. *Procedia Social Behavioral Sci.* 15: 2400–2405.

Kittur, S. J. 2017. Citation analysis of doctoral theses submitted to department of agronomy in university of agricultural sciences, Dharwad: obsolescence study. *Int. J. Inf. Manage.* 2(5): 35-39.

Kolbe, R. H. and Burnett, M. S. 1991. Content-analysis research: An examination of applications with directives for improving research reliability and objectivity. *J. Consum. Res. 18*(2): 243–250. Available at: https://doi.org/10.1086/209256

Krippendorf, K. 1980. *Content Analysis: An Introduction to its Methodology*. Sage Publications. Beverly Hills, California, 441p.

Krippendorff, K. 2004. *Content Analysis: An Introduction to Its Methodology* (2nd Ed.). Sage Publications, 413p.

Kumar, R., Chahal, P., Ghanghas, B., and Yadav, K. 2017. To study the residential background and performance of agriculture students in academics. *Int. J. Educ. Manage. Stud.*, 7(4):573–574.

Kumar, P., Reena, N. S., and Meena. 2010. Rural Urban Background and academic performance of agricultural students. *Agric. Sci. Digest.* 30(1):75-76.

Kuruppu, P. U. and Moore, D. C. 2008. Information use by PhD students in agriculture and biology: A dissertation citation analysis. *Portal: Libr. Acad. 8*(4): 387–405. Available at: https://doi.org/10.1353/pla.0.0024

Laband, D.N. 2013. On the use and abuse of economics journal rankings. *Econ. J.* 123 (570): 223–254.

Lakhotia, S. C. 2017. Mis-conceived and mis-implemented academic assessment rules underlie the scourge of predatory journals and conferences. *Proc. Indian Natl. Sci. Acad.* 83: 513– 515.

Lakshmi, V. V., Bindu, E. S. H., Latha, C. S., Paul, M. M., and Pavani, N. 2021. Study on NAAS rated journals in the field of family resource management. *Nat. Volatiles Essent. Oils*. 8(4): 7481–7489.

Larivière, V. 2013. PhD Students' Excellence Scholarships and Their Relationship with Research Productivity, Scientific Impact, and Degree Completion. *Can. J. High. Educ.* 43(2): 27-41. Available at: https://doi.org/10.47678/cjhe.v43i2.2270

Liebano, R., Dias, S., and Ferreira, L. 2005. Number of objectives and conclusions in dissertations and thesis. *Acta Cirúrgica Brasileira.* 20: 272–274. Available at: https://doi.org/10.1590/S0102-86502005000400002

Malekmohammadi, I. 2009. Interpretive perspective of knowledge management stance in agricultural knowledge information system to fostering research/extension linkage. *Am. J. Agric. Biol. Sci.* *4*(3), 230–241. Available at: https://doi.org/10.3844/ajabssp.2009.230.241

Meerah, T. S. M., Osman, K., Zakaria, E., Ikhsan, Z. H., Krish, P., Lian, D. K. C., and Mahmod, D. 2012. Measuring graduate students research skills. *Procedia Soc. Behav. Sci.* *60*: 626–629. Available at: https://doi.org/10.1016/j.sbspro.2012.09.433

Mehra, N. and Trikha, R. N. 1993. Content analysis of post-graduate theses of agricultural communication. *Indian J. Ext. Educ.* 29 (3&4): 56-58.

Mihailescu, M. 2019. *Content analysis*. Available at: https://doi.org/10.13140/RG.2.2.21296.61441 [15 December 2021].

Moorthy, S. 2018. Problem solving skills among college students. *Int. J. Innov. Res. Explor.* 5(4): 207–214.

Murnane, R. and Phillips, B. R. 1981. Learning by doing, vintage, and selection: Three pieces of the puzzle relating teaching experience and teaching performance. *Econ. Educ. Rev.* 1(4): 453–465.

Nachmias, D. and Nachmias, C. 1976. *Research Methods in the Social Sciences* [5th Ed.]. St. Martin's Press, New York, 243p.

Nagpal, R. and Mukhopadhyay, J. 2012. Problems faced by PhD scholars in academic institutions in India: Part – 1 [on-line]. Available at:

https://www.academia.edu/29350679/Problems_faced_by_PhD_Scholars_in_Academic_Institutions_in_India_Part_1 [13 October 2021].

Natekar, A. R. 2013. Problems encountered by researcher scholars while conducting research: A case study of research scholars of few selected universities of Karnataka. *Res. J. Phil. Social Sci.* 39(2):48-53.

Nathalal, V., Sarsavadia, P., and Yadav, D. 2015. Students' perception towards agricultural engineering education in Junagadh Agricultural University. *AGRES – An International e-Journal.* 4: 53–64.

NCES [National Centre for Education Statistics]. 2018. Digest of Education Statistics, U. S. Department of Education [on-line]. Available at: https://nces.ed.gov/fastfacts/display.asp?id=98 [17 November 2021].

*Neumann, R. 2012. *The Doctoral Education Experience: Diversity and Complexity.* Australian Government, Canberra, Australia. 205p.

Newcomb, L. H. 1993. Transforming university programs of agricultural education. *J. Agric. Educ.* 34(1): 1-10.

Norris, P. 2021. What maximizes productivity and impact in political science research? *European Polit. Sci.*, 20: 34-57 Available at: https://doi.org/10.1057/s41304-020-00308-4

O'Leary, Z. 2014. *The Essential Guide to Doing your Research Project.* Thousand Oaks, Sage Publications, California, 239p.

Olson, C. M. 1994. Publication bias. *Acad. Emerg. Med.* 1:207-209.

Pal, S., Rahija, M., and Beintema, N. 2019. India- Recent developments in agricultural research *Gates Open Res.* 3(1175):1175. Available at: https://doi.org/10.21955/gatesopenres.1116042.1

Papanastasiou, E. C. 2005. Factor structure of the "attitudes toward research" scale 6, *Int. Assoc. Statist. Educ.* 4(1):16 – 26.

Patel, D. J. 1992. A study on teaching effectiveness of teachers working in Gujarat Agricultural University with special reference to Faculty of Agriculture. Ph.D. (Ag) thesis, Gujarat Agricultural University, Anand, 290p.

Patwardhan, B., Nagarkar, S., Gadre, S., Lakhotia, S., Katoch, V., and Moher, D. 2018. A Critical Analysis of the 'UGC-Approved List of Journals.' *Curr. Sci.*, *114*(6): 1299-1303. Available at: https://doi.org/10.18520/cs/v114/i06/1299-1303

Pearson, J. C. and Nelson, P. E. 2000. *An Introduction to Human Communication: Understanding and Sharing* [8th Ed.]. McGraw Hill, USA, 410p.

Prasad, D.B. 2008. Content analysis a method in social science research. In: Lal Das, D.K and Bhaskaran, V (eds.). (2008) *Research Methods for Social Work,* New Delhi, Rawat, pp.173-193.

Prolima, T. and Kaushik, S. 2000. Content analysis of home science extension research articles published in IJEE. *Indian J. Ext. Educ.* 36 (3-4): 160-163.

Pyhältö, K., Toom, A., Stubb, J., and Lonka, K. 2012. Challenges of becoming a scholar: A Study of doctoral students' problems and well-Being. *ISRN Educ.* 2012:1-12. Available at: https://doi.org/10.5402/2012/934941

Qasem, M. 2015. Evaluation of statistical methods used in Ph.D. theses of social sciences in Indian universities. *Int. J. Sci. Res.*6(3): 2926-2931.

Rajagopal, V. and Rameshkumar, M. P. 2005. Standard of scientific research publications. *Curr. Sci.* 88 (2): 207-208.

Ramos, R., Duque, J., and Nieto, S. 2012. Decomposing the rural-urban differential in student achievement in Colombia using PISA microdata. *SSRN* (e-journal). ISSN 1556-5068. Available at: https://doi.org/10.2139/ssrn.2051358 [7 December 2021].

Ramsden, P. 1994. Describing and explaining research productivity. *High. Educ.* 28(2): 207–226.

Rathinasabapathy, G., Lakshmanan, R., and Kopperundevi, S. 2014. NAAS rating of indian journals in the field of veterinary and animal sciences: A study. *Asian J. Libr. Inf. Sci. 6 (3&4)*:57–68.

*Reddy. V. C. 1980. An investigation into the teacher effectiveness and attitude towards teaching in secondary school teachers in chittor district, M.Ed. dissertation (unpublished.) Sri Venkateswara University, Tirupati, India.159p.

Reynolds, P. D. 1971. *A Primer in Theory Construction*. Bobbs-merrill Co. 184p.

Sabbah, S. 2020. Communication skills among undergraduate students at Al-Quds University. *World J. Educ.*10(6): 136–142. Available at: https://doi.org/10.5430/WJE.V10N6P136

Sahay, A. 2015. *Doctoral Degree in India: The Need for Transformation*. Bloomsbury.

Saidi, S. and Siew, N. M. 2018. Assessing students' understanding of the measures of central tendency and attitude towards statistics in rural secondary schools. *Int. Electr. J. Math. Educ.* 14(1):73-86. Available at: https://doi.org/10.12973/iejme/3968

Samantha, D. K. 1985. Perception of work environment by agricultural research service scientist of ICAR, Institute. *Indian J. Ext. Educ.* 21(3&4):53-61.

Seher, U., Remziye, S., Kizilcik, O.Z. and İlker, A. 2018. Attitude of nursing students toward scientific research a cross-sectional study in turkey. *J. Nurs. Res.* 26 (5): 356-361.

Shelton, E. N. 2003. Faculty support and student retention. *J. Nurs. Educ.* 42:68–76.

Shukul, M. 1981. Academic Performance of Students with Rural and Urban Background in Agriculture. M.Sc. (Ag.) Theses, Chaudhary Charan Singh Haryana Agricultural University. 63p. Available at: https://krishikosh.egranth.ac.in/handle/1/5810075243

Siamian, H., Mahmoudi, R., Fatemeh, H., Latifi, M. and Zare-Gavgani, V. 2015. Students attitudes towards research at Mazandaran University of Medical Sciences. *J. Acad. Med. Sci.* 28(6): 468-472.

Singh, A. and Gill, S. S. 1993. Review of adoption research studies in Indian Journal of Extension Education from 1980 to 1987. *Indian J. Ext. Educ.* 29 (1-2): 89-92.

Sujan, D. K. 1986. A report on Extension and Communication studies of G. B. Pant University of Agriculture and Technology. Pantnagar, Uttarakhand.

Stoilescu, D., and McDougall, D. 2010. Starting to publish academic research as a doctoral student. *Int. J. Doctoral Stud.*, *5*:79–92. Available at: https://doi.org/10.28945/1333

Thakur, M. K. and Trikha, R. N. 2004. Content analysis of post graduate theses in development communication. *Nepal Agric. Res. J.* 5:28-32.

Thanuskodi, S. 2012. Citation analysis of doctoral research in botany submitted to annamalai university. Int. J. Libr. Sci. 1(1): 8-12. Available at: http://article.sapub.org/10.5923.j. library.20120101.02.html

UGC [University Grants Commission]. 2019. Improving the quality of research by faculty and creation of new knowledge and strategies for improving research culture in colleges/universities. Report 2019. New Delhi, India.

Verma, S. 2017. Researches conducted on extension communication methods. B.H.U- a content analysis. M.Sc. (Ag) thesis, Banaras Hindu University, Varanasi, 60p.

*Vimala, V. 1997. Bibliometric study of citations in Ph.D. theses in biological sciences. Ph.D. Thesis. Sri Venkateswara University, Tirupati (Unpublished).

Wao, H. and Onwuegbuzie, A. 2011. A mixed research investigation of factors related to time to the doctorate in education. *Int. J. Doctoral Stud.*, *6*. Available at: https://doi.org/10.28945/1505

Weber, R. P. 1990. Basic Content Analysis. Sage University Paper Series on Quantitative Applications in the Social Sciences, Series no. 07-049. Sage Publications, California, 97p.

Williams, D. and Coles, L. 2003. The use of research by teachers: information literacy, access and attitudes: a final report of research funded by ESRC. Department of Information Management, Aberdeen Business School, The Robert Gordon University, Scotland. 118p.

Yavuz, S. 2016. A content analysis related to theses in environmental education: the case of turkey (2011-2015). *J. Educ. Train. Stud.* 4(10): 118-125. Available at: https://doi.org/10.11114/jets.v4i10.1794

Yeap, C. and Kaur, K. 2008. Citation study of library and information science dissertations for collection development. *Malays. J. Libr. Inf. Sci.13*(2): 29-47.

Zafrunnisha, N. 2012. Citation Analysis of PhD Theses in Psychology of Selected Universities in Andhra Pradesh, India. Library Philosophy and Practice.

Zavyalova, A., Pfarrer, M. D., Reger, R. K., and Shapiro, D. L. 2012. Managing the message: the effects of firm actions and industry spillovers on media coverage following wrongdoing. *Acad. Manag. Ann.* 55(5):1079–1101.

n.d.- no date

*not seen directly

Appendices

APPENDIX I

Categorisation of theses department wise and PC group wise based on years

1) Department of Agronomy

Sl.No.	Title of Thesis	PC Group	Name of Researcher
2016			
1	Herbicide Mixtures for Weed Management in Direct Seeded Puddled Rice (*Oryza sativa* L.)	PP	Sheeja K Raj
2	Nutrient and Moisture Optimization in Banana (*Musa* AAA. Grand Nain)	FR	Bindhu J.S.
3	Agronomic Interactions for Sustainable Rice based Cropping System in Paddy Fields	RBC	Vipitha V.P
4	Nutrient Management for Organic Rice Based Cropping System	OF	Nishan M.A
5	Production Package of Palisade Grass	FGM	Sharu S.R.
2017			
1	Tillage and Nutrition for Productivity Enhancement in Tannia (*Xanthosoma sagittifolium* (L.) Schott)	STC	Atul Jayapal
2	Precision Farming in Banana (*Musa* AAA Nendran) for Productivity Enhancement	FR	Pintu Roy Vattakunnel
3	Acidity Amelioration and Nutrient Management Practices for Mitigating Yield Constraints of Rice in Vaikom Kari	RBC	Devi V.S.
4	Invasion Impact of Greater Club Rush (*Scirpus grossus* L.f) on Wetland Rice Ecosystem	NRM	Gayathri Karthikeyan
2018			
1	Bio efficacy and Soil Health Impact of Flucetosulfuron in Wet Seeded Rice (*Oryza sativa* L.)	R	Arya, S.R.
2	Management of Blood Grass (*Isachne miliacea* Roth ex Roem *et*. Schult) in Wetland Rice Ecosystem	R	Renjan.B
3	Calibration and Validation of Ceres- Rice Crop Simulation Model	FSRCS	Anju,V.S.
2019			
1	Customized Nutrient Management for Rice (*Oryza sativa* L.) IN THE Southern Laterites (AEU 8)	R	Sheeba, S.S.

2	Vetiver Based Organic Mediculture Technologies for the Sustainable Development of Watersheds	AMP	Ishrath, P.K.

2) Department of Soil Science and Agricultural Chemistry

Sl.No	Title of Thesis	PC Group	Name of Researcher
2015			
1	Investigations on the efficiency of biochar from tender coconut husk for enhanced crop production	SA	Mariya Dainy M.S.
2	Assessment and management of micronutrient deficiencies in onattukara	SA	Mini, V.
2017			
1	Impact of assessment of landfill on soil health and water quality in a waste disposal site	NRM	Fasila, E. K.
2	Evaluation of customised organic fertilizer in relation to labile carbon dynamics nutrient release characteristics and productivity of banana	NRM	Naveen Leno
3	Phytoremediation of inorganic contaminants in Vellayani wet land ecosystem	SA	Meera, A.V
4	Technology refinement for biochar production and evaluation of its effect on soil health and crop productivity	SA	Sainath Nagula
5	Characterisation and evaluation of on-farm liquid organic manures on soil heal]th and crop nutrition	OF	Sreya, U. Parvathi
2019			
1	Organic nano NPK formulations for enhancing soil health and productivity	SHOF	Nibin, P.M.

3) Department of Horticulture

Sl.No.	Title of thesis	PC Group	Name of researcher
Vegetable Science			
2015	Development of F1 hybrids of indeterminate tomato (*Solanum lycopericum* L.) for protected cultivation	VEG	Lekshmi S.L.

2017	Standardization of agrotechniques for precision farming in watermelon (*Citrullus lanatus* (Thumb) Mastum. & Nakai)	VEG	Nisha S.K.
2019	Development of chilli (*Capsicum annum* L.) hybrids with leaf curl virus resistance, high yield and quality	VEG	Vijeth S.
Pomology and Floriculture			
2015	Performance analysis and combining ability studies in anthurium	FL	Sheena A.
2017	Collection and evaluation of marigold (*Tagetes spp*.) genotypes for humid tropics	FL	Shajma Nafeesa Basheer
2019			
1	Evaluation of propagation techniques and rootstock studies of mango(*Mangifera indica* l.)	FR	Rehma. U. R.
2	Ecophysiology and screening for climate change resilience in Mango (*Mangifera indica* L.) genotypes	FR	Aswini A.
Plantation crops and Spices			
2017	Diversity analysis and reproductive biology of milk yam (*Ipomea digitata* L.)	AMP	Vidya K.M.
2018	Developmental morphology of tuberization and phytochemical profiling in milk yam (*Ipomea digitata* L.)	AMP	Sonia N.S.
Post-Harvest Technology			
2016	Instant juice powders of cashew apple (*Anacardium occidentale* L.) and pineapple (*Ananas comosus* L. Merr.)	PHT	Rafeekhar M.
2018	Aloe vera based edible film coating for shelf life extension in tomato	PHT	Thushara T. Chandran

4) Department of Agricultural Entomology

Sl.No.	**Title of Thesis**	**PC Group**	**Name of Researcher**
2015			
1	Entomopathogenic Fungi for Management of Insect Pests in Rice ecosystem	PP	Mailini Nilamudeen
2017			
1	Management of banana pseudostem weevil, (*Odoiporus longicollis* (Olivier)), using safe chemicals and bio-rational methods	PP	Sivakumar, T.
2	Characterization and Management of Insecticide in *Spodoptera litura* (FABRICUS) (Lepidoptera: Noctuidae)	PP	Pattapu Sreelakshmi
2018			
1	Bio-Ecology and Management of Borer Pests Infesting Yard Long Bean, *Vigna unguiculata subsp. sesquipedalis* (L.) Verde	PP	Sontakke Pritin Pramod
2	Dissipation and Risk Assessment of Select Insecticides used for Pest Management in Cabbage and Cauliflower	CPBI	Anju Padmanabhan
3	Microbial Consortium for the Management of Insect Pests of Bitter gourd (*Momordica charantia* L.)	PP	Naveeda S.

5) Department of Plant Pathology

Year	Title of thesis	PC Group	Name of researcher
2016			
1	Strain Evaluation and Production Technology of Shitake Mushroom (*Lentinula edodes* (Berk.) Pegler)	BO	Deepa Rani C.V
2	Integrated Management of Foliar Fungal Disease of Culinary Melon (*Cucumis melo* L. *var. acidulus Naudin*)	PP	S. Narmadavathy
2017			
1	Characterization and Exploitation of Jelly Mushrooms (*Auricularia spp./Tremella spp*.)	BO	Priya R U
2	Identification of Graft Transmissible Resistant Factors and Development of siRNA Mediated Resistance in Cassava Against Cassava mosaic geminivirus	PP	Asha B. Nair
2018			
1	Integrated Management of Viral Diseases of Bitter gourd (*Momordica charantia* L.)	PP	Radhika.N.S
2	Strain Improvement of Oyster Mushrooms- *Pleurotus cystidiosus.* K. Mill and *Pluerotus opuntiae* (Durieu and Lev.) Sacc.	PPBM	Krishnapriya P. J.

6) Department of Plant Physiology

Year	Title of thesis	PC Group	Name of researcher
2015			
1	Biochemical and Molecular Studies on Post-Harvest Physiological Deterioration of Cassava (*Manihot esculenta* Crantz)	STC	Saravanan.R
2	Marker Assisted Transfer of Thermosensitive Generic Male Sterility to High Yielding Red Kernelled Varieties of Rice (*Oryza sativa* L.)	BT	Niya Celine V.J.
2017			
1	Nutrio-Physiological and Molecular Analyses and Carbon dioxide Enrichment Studies of Coconut Palms (*Cocos nucifera* L.) with Foliar Yellowing	COP	Deepa,S.

2019			
1	Physiological Approaches for manipulating male sterility in thermosensitive generic male sterile system for hybrid rice seed production	BBBP	Gayathri Rajasekharan
2	Evaluation of CO2 Enrichment Effects on Resource Utilization in Cowpea (*Vigna unguiculata* L.) and Amarantus (*Amaranthus tricolor* L.)	CPB	Srikanth G. A

7) Department of Plant Breeding and Genetics

Sl.No	Title of thesis	PC Group	Name of researcher
2015			
1	Stability Analysis and Molecular Characterization of F1 Hybrids in Okra (*Abelmoschus esculentus* (L.) Moench)	VEG	Sreenivas Gogineni
2017			
1	Pyramiding Bacterial Leaf Blight Resistance Genes into Popular Varieties of Kerala Through Marker Assisted Selection	RBC	Ramaling Hundekar
2	Genetic Analysis of Drought Tolerance in Rice (*Oryza sativa* L.)	RBC	Patil Kranthikumar Haunsajirao
3	Inheritance of Yield and Resistence to Shoot and Fruit Borer (*Lucinodes arbonalis* Guen.) in Brinjal (*Solanum melongena* L.)	VEG	Gangadhara.k
4	Genotyping of Rf (Restoring Fertility) Loci of Rice Varieties of Kerala using Molecular Markers	RBC	Rajib Das
5	Characterization and Genetic Improvement in Rose (*Rosa spp*.) through Mutagenesis	FL	Brunda S.M.
6	Identification of Potential Donors for Superior Fruit Quality Traits and Genes for Resistance to Tomato Leaf Curl (TolCV) in Tomato and Allied Species	VEG	Nandkarni Siddhesh Raghavendra
7	Development of Near Isogenic Lines of Rice Variety ‘UMA’ for Blast Resistance Genes Through Molecular Marker Assisted Backcross Breeding	RBC	Harikrishnan, P.J
2018			
1	Induced Mutagenesis for Delayed Flowering and High Tillering in Guinea Grass (*Panicum maximum* Jacq.)	FGM	Sudrik Bibhishan Popat
2	Stability Analysis and Molecular Characterization of F1 Hybrids in Brinjal (*Solanum melongena* L.)	VEG	Kavishetti Vinay Vishwanath
3	Introgression of Mosaic Resistance in Popular Short Duration Cassava Varieties of Kerala Through Marker Assisted Selection	STC	Darshan, S

4	Distant Hybridization and Compatibility Studies in Wild Orchids	FL	Seeja G.
2019			
1	Genetic Analysis of Yield and Quality in Fodder Cowpea (*Vigna unguiculata* (L.) Walp.	FC	Praveena V. S.

8) Department of Plant Biotechnology

Year	Title of Thesis	PC Group	Name of Researcher
2016	Development of small interfering RNA (siRNA) mediated resistance in banana against banana bract mosaic virus	BT	Lekshmi R.S.
2019	Isolation, characterization and evaluation of P1 and Bp genes in relation to inflorescence architecture in black pepper (*Piper Nigrum* L.)	BBBP	Smitha Bhasi

9) Department of Agricultural Economics

Year	Title of Thesis	PC Group	Name of Researcher
2015	Ecosystem Valuation of Wetlands: A Case Study of Vellayani Lake	AES	Ashwathy Vijayan

10) Department of Agricultural Extension

Year	Title of thesis	PC group	Name of researcher
2016			
1	Indicators of Sustainable Agricultural Development; A Multivariate Analysis among Self-Help Groups of “Kutumbasree Mission” in Thiruvananthapuram District	AEDS	Chinchu.V.S
2	Agricultural Information Support Service Vis-À –Vis Kisan Call Centre: A Performance Auditing	AEDS	Shely Mary Koshy
2018			
1	Organic Farming as a Strategy for Climate Change Adaptation- An Exploratory Study	AEDS	Sangeetha.K.G.
2	Performance Effectiveness of Technology Dissemination System of State Department of Agriculture in Kerala and Andhra Pradesh: A Comparative Analysis	AEDS	Modem Ravikishore

11) Department of Community Science

Year	Title of thesis		Name of researcher
2015			
1	Exploring the health potential of honey and development of a value added nutraceutical drink	FSN	Krishnasree V.
2	Nutrient composition, antioxidant and hypoglycemic effect of bitter gourd (Momordica charantia L.)	FSN	Krishnendu J. R.
2018			
1	Profiling bioactive componds and nutrients in jackfruit (Artocarpus heterophyllus Lam.) and developing a jackfruit based textured vegetable protein	FSN	Anila, H. L.
2019			
1	Detriments of nutritional status and lifestyle diseases among middle- aged working women	FSN	Siji M.S.

APPENDIX II

Thrust areas of PhD research under each PC group from 2011-2014

Code	PC Groups	f
	PC GROUP 1: RICE AND RICE BASED CROPPING SYSTEM (RBC)	
RBC 1	Collection, conservation and cataloguing of rice germplasm-traditional rice varieties, improved rice varieties, exotic rice varieties	0
RBC 2	Breeding for-higher yield, quality, resistance to biotic stress, resistance to abiotic stress, millers choice	0
RBC 3	High tech innovations for crop production-Hybrid rice, transgenic rice and others	0
RBC 4	Integrated Nutrient Management- use of organics and inorganics, Nutrient use efficiency, use of ameliorants	0
RBC 5	Development of location specific agro techniques- specialized crop techniques, rice-fish culture and others	2
RBC 6	Integrated pest and management- insects, diseases, weeds and others	0
RBC 7	Water management- irrigation, drainage	0
RBC 8	Seed technology- seed production, storage and quality	0
RBC 9	Mechanization in rice cultivation- Improvisation of existing technology, development of new technology	0
RBC 10	Molecular and conventional approach to crop improvement	0
RBC 11	Post -harvest technology –processing technologies, value addition, product diversification, byproduct utilization.	0
RBC 12	Socio-economic dimension- gender and social crisis, marketing and pricing, organizational concepts , policy perspectives	0
RBC 13	Ecofriendly and integrated plant nutrient management for sustainable rice production	0
RBC 14	Molecular markers for yield, quality and resistance to biotic and abiotic stresses	2
RBC 15	Site specific crop management strategies foliar application etc for targeted yields	0
RBC 16	Unraveling factors limiting productivity of rice in different soils and ecosystems and formulation of technologies	1
	PC GROUP 2: COCONUT AND OTHER PALMS (COP)	
COP 1	Germplasm conservation and evaluation	0
COP 2	Breeding for higher production and quality	0
COP 3	Breeding coconut varieties for pest/disease resistance	0
COP 4	Nutrient management and irrigation requirement	0
COP 5	Breeding and management of crop under stress conditions	0
COP 6	Palm based farming system	0
COP 7	Management of pest and disease problems	1
COP 8	Management of root(wilt) affected coconut gardens	0
COP 9	Coconut product diversification	0

COP 10	Mechanization in palms	0
COP 11	Development of value added products	0
	PC GROUP 3: VEGETABLES	
VEG 1	Breeding in solanaceous vegetables for- yield, quality, biotic stress, resistance to biotic stress	2
VEG 2	Breeding in cucurbits for- yield, quality, biotic stress, resistance to abiotic stress	0
VEG 3	Breeding in leafy vegetables, leguminous vegetables and bhindi for- yield, quality, resistance to biotic stress, resistance to abiotic stress	0
VEG 4	Improvement of underexploited vegetables	0
VEG 5	Standardization of agro-techniques in vegetable crops and protected cultivation	0
VEG 6	Vegetable seed production	0
VEG 7	Cool season vegetables	0
VEG 8	Developing database on land races of vegetables	0
VEG 9	Export oriented vegetables	0
VEG 10	Hybrid Vegetables	0
VEG 11	Development of non-bolting varieties in amaranthus	0
VEG 12	Hi-tech production package with special reference to protected cultivation and precision	1
VEG 13	Hybrid and high tech production	3
VEG 14	Breeding of leguminous vegetables	0
VEG 15	Development of varieties and technologies for protected cultivation	0
VEG 16	Site specific crop management strategies for targeted yields	0
VEG 17	Development of packages for protected cultivation/precision farming	0
VEG 18	Development of varieties with multiple resistance to major biotic and abiotic stresses	0
VEG 19	Vegetables: Breeding for yield, pest resistance of yard long bean	0
VEG 20	Developing F1 hybrids in major vegetables	0
	PC GROUP 4: SUGAR AND TUBER CROPS	
STC 1	Survey ,collection, preservation, maintenance and evaluation of germplasm of tuber crops	0
STC 2	Standardization of agro-techniques for tuber crops and breeding for yield, quality, pest and disease resistance	0
STC 3	Integrated nutrient management for tuber crops	0
STC 4	Collection, identification, improvement, maintenance and standardization of agro techniques for underexploited tropical root and tuber crops	0
STC 5	Trade oriented production of tuber crops through diversification and development of value added products	1
STC 6	Exploration, conservation and evaluation of genetic resources of sugarcane and sugar yielding crops	0

STC 7	Standardization of management practices of sugarcane for different situations	0
STC 8	Sugarcane breeding for yield, quality, pest and disease resistance	0
STC 9	Cropping systems involving sugar and tuber crops	0
STC 10	Constraint analysis and strategies for breaking yield barriers in tuber crops viz. cassava, sweet potato and tannia	1
STC 11	Production economics, processing, product development and marketing	0
	PC GROUP 5: FRUITS	
FR 1	Collection, conservation, characterization and utilization of germplasm of fruit crops	0
FR 2	Breeding for-yield, quality, resistance to biotic stress, resistance to abiotic stress	0
FR 3	Development of location/crop specific technologies for existing/new crops and varieties of fruit crops	0
FR 4	Field level management of pest, disease and weed incidence through - chemical, biological, integrated management methods	0
FR 5	Standardization of agro techniques for homestead and commercial cultivation of fruits	0
FR 6	Standardization of propagation techniques for rapid multiplication and production of elite planting materials	0
FR 7	High-tech innovative fruit culture(high density planting, fertigation, use of bio regulators, protected cultivation, roof top cultivation, canopy regulation and tree size control etc.)	1
FR 8	Management practices including fertigation for high productivity	1
FR 9	Development of technologies for export-oriented cultivation of fruits	0
FR 10	Development of agro techniques for subtropical and temperate fruits	0
FR 11	Product diversification and value addition	0
FR 12	Development of eco-friendly plant protection measures for major pests, diseases and nutritional disorders	0
	PC GROUP 6: FLORICULTURE	
FL 1	Germplasm collection, conservation, evaluation and improvement of export oriented flowers, foliage, aquatic plants and other plants of ornamental value	1
FL 2	Standardization of production technology for commercial flowers, cut foliage, dry flowers and plant products	0
FL 3	Standardization of protected cultivation technology in cut flowers and foliage	1
FL 4	Standardization of seed production technology of annual flowers and ornamentals	0
FL 5	Standardization of nursery; production and large scale propagation techniques for commercial flowers, foliage and other ornamentals	0
FL 6	Organic production technology in floriculture	0

FL 7	Evaluation of indigenous flora and introduction of new ornamentals	0
FL 8	Lawn grasses and lawn management	0
FL 9	Indoor plants and interior plan scaping	0
FL 10	Post-harvest handling, value addition and marketing of commercial flowers, foliage and other ornamentals	0
FL 11	Traditional flowers	1
FL 12	Developing improved varieties suited to humid tropics	0
FL 13	Standardization of production package of high value crop in protected structures	0
FL 14	Creation of novel genotypes through *in vitro* mutagenesis	1
	PC GROUP 7: SPICES AND PLANTATION CROPS	
SPC 1	Introduction, exploration, collection, conservation characterization and evaluation of genetic resources	0
SPC 2	Flowering, fruit set and fruit development	0
SPC 3	Breeding for high yield and quality	0
SPC 4	Breeding for tolerance/resistance to biotic and abiotic stresses	0
SPC 5	Standardization of agro techniques	0
SPC 6	Integrated nutrient and irrigation management	0
SPC 7	Integrated pest and disease management	0
SPC 8	Organic farming	0
SPC 9	Investigation on emerging pest and diseases	0
SPC 10	Value addition	0
	PC GROUP 8: PULSES AND OILSEEDS (POS)	
POS 1	Exploration, conservation and evaluation of genetic resources in pulses, oilseeds and minor non-edible oil seed crops	0
POS 2	Breeding for yield and quality in pulses	0
POS 3	Breeding for yield and quality in oilseeds	0
POS 4	Breeding for biotic and abiotic stress in pulses	0
POS 5	Breeding for biotic and abiotic stresses in oilseeds	0
POS 6	Standardization of management practices for specific resource condition in pulses	0
POS 7	Standardization of management practices for specific resource condition in oilseeds	0
POS 8	Pest and disease management in pulses and oilseeds	0
POS 9	Post-harvest processing and storage of pulses and oilseeds	0
POS 10	Production economics and marketability of pulses and oil seeds	0
POS 11	Identification /development of promising varieties/ cultures in underexploited legumes of humid tropics	0
	PC GROUP 9: FORAGE AND GREEN MANURE CROPS	
FGM 1	Crop improvement of fodder and green manure crops with respect to yield and quality	0
FGM 2	Standardization of agro techniques for fodder and green manure crops in different farming system	0
FGM 3	Developing varieties suited to shaded uplands, drought etc.,	0

FGM 4	Fodder and green manure crop based studies for edaphic enrichment	0
FGM 5	Biotechnological studies in fodder crops to combat biotic and abiotic stress	0
FGM 6	Utilization of non -conventional forages	0
	PC GROUP 10: AROMATIC AND MEDICINAL PLANTS (AMP)	
AMP 1	Exploration, collection and evaluation of germplasm of medicinal and aromatic plants	0
AMP 2	Crop improvement in medicinal and aromatic plants	0
AMP 3	Standardization of agro techniques for medicinal and aromatic plants in different cropping systems	0
AMP 4	Management of pests and diseases of aromatic and medicinal plants	0
AMP 5	Processing and utilization of aromatic and medicinal plants products	0
AMP 6	Chemical, characterization and quality evaluation of aromatic oils and medicinal plant products	0
AMP 7	Marketing of medicinal and aromatic plants including IPR issues	0
AMP 8	Development of cultivation practices for high value medicinal plants suitable for the State	1
AMP 9	Development of neutraceutical products of commerce from medicinal plants	1
	PC GROUP 11: SOILS AND AGRONOMY (SA)	
SA 1	Fundamental studies on soils and climatic factors in relation to crop growth	
	i. Characterization of micronutrients	1
	ii. Critical levels of nutrients	1
	iii. Weather based forecasting models for yield, pest and disease incidence	
SA 2	Characterization and management of soils problems limiting crop growth	
	i. Soil salinity	0
	ii. Soil acidity	0
	iii. Toxic elements	0
	iv. Drained soils	0
	v. Degraded laterites	0
	vi. Other soil physical constraints	0
SA 3	Pedalogical investigations, land/soil quality appraisal	0
SA 4	Agro Techniques for water management in crops and cropping system including dry land farming	0
SA 5	Soil nutrient transformations	
	i. Biochemical	0

	ii. Microbiological	0
	iii. Nutrient interactions	0
SA 6	Soil erosion and water shed management	0
SA 7	Soil fertility evaluation techniques and integrated plant nutrient management	2
SA 8	Agronomic management of crops including weed management and herbicides	0
SA 9	Technology and management of the components in the integrated farming system	0
SA 10	Soil pollution in agro ecosystems, remediation and long –term effects of manures/fertilizers	0
SA 11	Characterization and management of secondary and micronutrients for maximum productivity	0
SA 12	Bioremediation of toxicity in soil and water	1
SA 13	Weed management and herbicides residue analysis	0
SA 14	Management of secondary and micronutrients for maximizing productivity	0
SA 15	Research to address soil deterioration and maintaining soil quality	0
SA 16	Low cost substitute for fertilizer	0
	PC GROUP 12: PLANT PROTECTION	
PP 1	Identification and characterization of pest and disease incidence	0
PP 2	Ecology and systematics of pests, nematodes and pathogens	0
PP 3	Strategy for biological control-Pest, Nematode and Disease	0
PP 4	Strategy for pest, nematode and disease management i. Chemical ii. Integrated management	1
PP 5	Monitoring and forecasting of pest, nematodes and disease incidence	0
PP 6	Residual toxicity of pesticides	0
PP 7	Serodiagnosis for the production of disease free planting materials	0
PP 8	Ornithology	0
PP 9	Alternate methods for managing insect pest, diseases nematodes and weeds as a substitute for banned chemicals Kerala	7
PP 10	Molecular characterization of insect pests, plant pathogens and biological control agents	0
PP 11	Characterization of insect pests, plant pathogens and bio control agents	0
PP 12	Developing plant based formulations for pest and disease management	0
	PC GROUP 13: BIOTECHNOLOGY	
BT 1	In vitro propagation	0
BT 2	In vitro crop improvement	0
BT 3	In vitro production of secondary metabolites	0
BT 4	Genetic modification of plants and microbes	0
BT 5	Molecular marker analysis	1
BT 6	Genomics and proteomics	1

	i. Genetic transformation	
BT 7	Bioinformatics	0
BT 8	Molecular marker and marker assisted selected	0
BT 9	Molecular diagnostic/characterization	0
BT 10	Integrated biotechnology	0
	PC GROUP 14: POST-HARVEST TECHNOLOGY	
PHT 1	Post-harvest handling and marketing	0
PHT 2	Post-harvest storage and preservation	0
PHT 3	Processing product development and utilization	0
PHT 4	Agro-waste utilization	0
PHT 5	Post-harvest biotechnology- Secondary metabolite production	0
PHT 6	Development of post-harvest management of under exploited crops of Kerala	0
PHT 7	Value addition and product diversification	0
PHT 8	Packaging and storage of commercially important agri produce for internal consumption and export	0
PHT 9	Quality control studies	0
PHT 10	Grading standards	0
PHT 11	Maturity indices	0
PHT 12	By-product utilization	0
PHT 13	Product development for bulk use and technologies for enhancing shelf life in major perishable fruits	2
	PC GROUP 15: AGRICULTURAL EXTENSION and DEVELOPMENT STUDIES	
AEDS 1	Communication, adoption and diffusion of technologies and impact studies	0
AEDS 2	Leadership group dynamics and tribal agriculture	0
AEDS 3	Public-private partnership in agricultural extension, institutional innovations and market led extension	0
AEDS 4	Participatory approaches for sustainable agricultural development	1
AEDS 5	Agricultural extension management and human resource development	0
AEDS 6	Vocationalisation, entrepreneurship and employment generation	0
AEDS 7	Instructional technology, adult, distance and continuing education	0
AEDS 8	Location specific and need based extension strategies, methods and systems in agriculture	0
AEDS 9	Knowledge management and ICT in agriculture	1
AEDS 10	Agricultural statistics and labour studies	0
AEDS 11	Decentralization of People’s Planning	0
AEDS 12	Innovations in resources and crisis management in agriculture for poverty alleviation	1
AEDS 13	Agripreneurship development and participatory approaches in technology dissemination	0

AEDS 14	Impact assessment of technologies and refinement	0
AEDS 15	Research on transfer of technologies	1
AEDS 16	Indigenous Technical Knowledge (ITK)	0
AEDS 17	Research on utilization of technology	0
	PC GRUP 16: BENEFICIAL ORGANISMS (BO)	
BO 1	Bio inoculants and integrated plant nutrients managements	0
BO 2	Rhizobacteria and mycoinoculants for plant disease management	0
BO 3	Mushrooms as food, medicine and bioconversion agents	1
BO 4	Microbial diversity, identification of new sources of beneficial microorganisms from various ecosystems and microbial inoculum production	0
BO 5	Microbial biotechnology, genetic engineering and taxonomy of beneficial microorganisms	0
BO 6	Microbial agents and their formulations for pest and disease management	0
BO 7	Beneficial insects(honey bees, silkworm, pollinators, weed killers, parasitoids and predators)and earthworm	0
BO 8	Quality control of bio formulations	0
BO 9	Bio fertilizers	0
BO 10	PGPR organisms	0
BO 11	Soil plant health management and bioremediation	0
BO 12	Use of beneficial organisms/consortium for soil and plant health management, waste management and bioremediation	0
BO 13	Newer strains of edible and medicinal mushroom	1
	PC GROUP 17: FOOD SCIENCE and NUTRITION	
FSN 1	Food security, food consumption pattern and nutritional status	0
FSN 2	Food habits preferences, consumer reactions and ITK	0
FSN 3	Nutritional problems of the community and ameliorative measures	0
FSN 4	Quality evaluation of foods and food products	0
FSN 5	Technologies for food processing, value addition, diversification and conservation	0
FSN 6	Standardization and product development	0
FSN 7	Diet in health and diseases	1
FSN 8	Energy management an d working efficiency	0
FSN 9	Food biotechnology	0
FSN 10	Computer application for nutrition education and dietary counselling	0
FSN 11	Value addition and quality evaluation of foods and food products	1
FSN 12	Food quality evaluation	0
	PC GROUP 18: ORGANIC FARMING (OF)	
OF 1	Organic nutrition and soil health management	0

	i. Use of organic manures, bio-fertilizers and natural materials ii. Different composts and composting techniques iii. Green manuring iv. Organic amendments for soil moisture conservation and augmenting biological properties	
OF 2	Recycling of bio wastes (urban and rural) and crop residue management	0
OF 3	Development of crop specific/location specific agro techniques i. Organic production of cereals, fruits, vegetables, spices and medicines ii. Quality assessment and post-harvest technology	0
OF 4	Developing value added organic inputs-evaluation-production economics and marketing	0
OF 5	Strategies of total organic farming and organically based integrated nutrient management i. Nutrient management ii. Eco friendly pest, disease, weed and nematode management	0
OF 6	Developing quality parameters of organic inputs-evaluation and quality control, natural materials and commercially available organic inputs	0
OF 7	Organic certification-developing standards	0
OF 8	Residual effects and long term effects of organic inputs	0
OF 9	Biodynamic farming	0
OF 10	Strategies for sustainable organic farming in Kerala	1
OF 11	Eco friendly management of pest and diseases	0
OF 12	Revalidation of traditional practices in agriculture	1
OF 13	Development of concentrated liquid formulations and listing of enriched organic manures and formulations	0
	PC GROUP 19: GENDER STUDIES (GS)	
GS 1	Gender role analysis of farming systems i. Activity analysis of farming system ii. Time use pattern and energy utilization studies of farm operations by men and women	0
GS 2	Gender concerns in access and control of farm resources, natural resources, biodiversity, farmer support services and social institutions	0
GS 3	Gender issues, technological needs and constraints of women farmers	0
GS 4	Women farm labour, needs, constraints and livelihood security	0
GS 5	Occupational problems and health hazards of women in farming, ergonomic studies and women friendly technologies	0
GS 6	Women empowerment and women entrepreneurship i. Empowerment measurement studies ii. Empowerment through group approaches iii. Micro credits and micro enterprises	0

GS 7	Gender impact of farm technologies, extension policies, development programmes and farm support initiatives	0
GS 8	Gender sensitive agricultural development, training needs of scientists and development functionaries	0
GS 9	Engendering dimensions of ITK, IPR, biodiversity, agrarian changes and global trade relations	0
GS 10	Gender disaggregated database of agricultural sector and gender sensitive policy advocacy	0
GS 11	Research on gender specific issues in agricultural research, supervision, cultivation and selections for addressing the problems	0
GS 12	Entrepreneurship in agriculture	0
	PC GROUP 20: AGRO-ECONOMIC STUDIES (AES)	
AES 1	Natural resource and environmental economics	0
AES 2	Farm management and production economics	0
AES 3	Agricultural marketing, price policy and international trade	0
AES 4	Agricultural finance and project analysis	0
AES 5	Agricultural development economics and policies	0
AES 6	Market Intelligence studies	0
AES 7	Impact assessment of technologies	0
AES 8	Cost of production	0
AES 9	Analyzing international/National/State policies and sensitizing its impact on farm sector	0
AES 10	Economic impact and assessment of cost of production of major crops and technologies in Kerala	0
	PC GROUP 21: NATURAL RESOURCE MANAGEMENT (NRM)	
NRM 1	Tools and techniques for inventorisation, characterization and monitoring 0 of natural resources of Kerala	0
NRM 2	Monitoring of natural resource degradation and adaptation to mitigate its adverse effects on agricultural production systems	2
NRM 3	Remote sensing, GIS and other ICT tools for improvement in agricultural education, research and advisory services	0
NRM 4	Sustainable land use plans for agro-ecological zones in the State	0
NRM 5	Integrated input management for sustained soil health and crop productivity	1
NRM 6	Technologies for managing wetlands and water logged/saline lands	0
NRM 7	Participatory research and development of watersheds in various agro - ecological zones to enhance the productivity and resource conservation	0
NRM 8	Inter-disciplinary initiatives for farming systems and watershed research	0
NRM 9	Agro-eco-zone specific diversification of agriculture and hi-tech production systems	0
NRM 10	Plant biodiversity assessment through remote sensing	0
NRM 11	Precision Farming	

	PC GROUP 22: CROP PHYSIOLOGY and BIOCHEMISTRY	
CPB 1	Stress physiology-physiological basis of crop responses to biotic stresses, abiotic stresses and crop resilience to climate change	1
CPB 2	Physiological mechanism/constrains in crop productivity under modern farming system like precision farming/protected cultivation, mechanical, organic and aerobic farming system	0
CPB 3	Growth physiology of crops (flowering, reproduction, seed physiology and senescence)	0

Thrust areas of PhD research under each PC Group from 2015-2017

Code	Thrust areas	f
	PC GROUP 1: RICE	
R 1	Collection, conservation and cataloguing of rice germplasm	0
R 2	Breeding for higher yield, quality and resistance to biotic/abiotic stresses	0
R 3	Research on hybrid rice, transgenic rice and speciality rice	1
R 4	Development of location specific agro techniques for sustainable rice production	1
R 5	Management of abiotic stresses	0
R 6	Management of biotic stresses	2
R 7	Physiological approaches for enhancing crop productivity	0
R 8	Mechanisation in rice cultivation	0
R 9	Post-harvest technology in rice	0
R 10	Socioeconomic dimensions of rice cultivation in Kerala	0
	PC GROUP 2: SPICES AND PLANTATION CROPS	
SPC 1	Germplasm collection, conservation and evaluation	0
SPC 2	Breeding for high yield and quality	0
SPC 3	Breeding for pest and disease resistance / tolerance	0
SPC 4	Propagation and nursery techniques	0
SPC 5	Agrotechniques for yield and quality improvement	0
SPC 6	Integrated nutrient management	0
SPC 7	In situ moisture conservation and irrigation management	0
SPC 7	Integrated pest and disease management	0
SPC 8	Good agricultural practices and organic farming	0
SPC 8	Post-harvest handling and value addition	0
SPC 9	Biotechnology aspects	0
SPC 10	Developing user friendly machines	0
	PC GROUP 3: VEGETABLES	
Veg 1	Development of F1 hybrids in major vegetables	0
Veg 2	Development of vegetable varieties with resistance to major biotic and abiotic stresses	1
Veg 3	Development of packages for protected cultivation / precision farming for high productivity	1

Veg 4	Site specific crop management strategies in vegetables for targeted yields	0
Veg 5	Adaptability, improvement and large scale multiplication of under-exploited and ethnic vegetables, and cool season vegetables	0
Veg 6	Developing technologies for homestead, kitchen garden, grow bag and terrace vegetable cultivation including soil-less production technologies	0
Veg 7	Eco-friendly technologies for plant protection in vegetables with special emphasis on pests, diseases, birds and nutritional and physiological disorders	0
Veg 8	Seed production, processing, storage, testing and quality enhancement in vegetables	0
Veg 9	Collection, characterization and maintenance of germplasm of major vegetable	0
	PC GROUP 4: FRUITS	
FR 1	Collection, characterisation, documentation, conservation and evaluation of germplasm of major and minor fruits	0
FR 2	Identification/development of improved varieties for commercial cultivation and utilisation	0
FR 3	Refinement of propagation and management methods	1
FR 4	Development of organic management practices	0
FR 5	Management of pest and diseases	0
FR 6	Domestication, evaluation and management of exotic fruits	0
FR 7	Identification of subtropical fruit varieties for plains, development of agro techniques for subtropical and temperate fruits	0
FR 8	Identification of fruit crops and varieties suitable for homestead cultivation	0
FR 9	High tech fruit culture (high density planting, fertigation, tree size control, protected cultivation, canopy regulation etc)	0
FR 10	Biotechnological interventions in fruit crops	0
FR 11	Development of pre and post-harvest technologies for enhancing shelf life of major fruit crops.	0
FR 12	Product diversification, by-product utilisation and waste management of fruit crops	0
FR 13	Mechanisation in fruit cultivation, harvesting, postharvest handling and processing	0
FR 14	Influence of climatic variations in the performance of fruit crops	1
	PC GROUP: 5 FIELD CROPS – CEREALS (OTHER THAN RICE), MILLETS, PULSES, OIL SEEDS, FODDER CROPS AND GREEN MANURE CROPS	
	Cereals (other than rice) and millets	
FC 1	1. Screening and agro-techniques for millets and cereals other than rice for changing climatic conditions / major cropping systems of Kerala..	0

FC 2	2. Development of package of practices for baby corn, sweet corn and sweet sorghum	0
	Pulses	
FC 3	1. Screening varieties for stress situations and high yield	0 0
FC 4	2. Identification/ development of suitable varieties for rice fallows	0
FC 5	3. Agro techniques for yield maximization and quality improvement including mulching, fertigation and weed management	0
FC 6	4. Development of photo insensitive varieties in pulses	0
FC 7	5. Isolation and formulation of native bio fertilizers for pulse crops	0
FC 8	6. Plant protection methods including botanicals and microbial consortium	0
FC 9	7. Management of storage pests and diseases,	0
	Oil Seeds	
FC 10	1. Collection, conservation and cataloguing of germplasm of oilseed crops	0
FC 11	2. Developing high yielding varieties with tolerance to biotic and abiotic stresses suitable for rice based cropping system	0
FC 12	3. Weed management in oil seeds	0
FC 13	4. Harvesting and processing technology for oil seeds	0
FC 14	5. Investigating therapeutic and nutraceutical value of sesamum / ground nut	0
FC 16	6. Developing value added products	0
FC 17	7. Agrotechniques for under exploited oilseeds	0
	Fodder crops	
FC 18	1. Identifying high quality fodder crops / varieties	2
FC 19	2. Developing varieties suited to biotic and abiotic stresses and for soil conservation	0
FC 20	3. Developing package for plant protection, higher yield and quality.	0
FC 21	4. Improving seed setting in cereal and legume fodders	0
FC 22	5. Fodder preservation techniques	0
	Green manure crops	
FC 23	1. Green manuring in major cropping systems of Kerala for soil health and productivity	0
FC 24	2. Soil carbon sequestration and micro nutrient addition potential of green manure / green leaf manure crops	0
FC 25	3. Exploitation of green manure potential of non-conventional sources like mimosa, mikania, merrimia, wild coccinia etc.	0
	PC GROUP 6: FLORICULTURE	
FL 1	Protected cultivation and precision farming in commercial flowers and foliage	0

FL 2	Standardization of production technology and improvement of cut flowers and other ornamentals	0
FL 3	Evaluation of indigenous flora and introduction of new ornamentals	0
FL 4	Post-harvest handling, value addition and market studies	0
FL 5	Interior plant scaping and pollution abatement studies	0
FL 6	Landscape horticulture	0
	PC GROUP 7: ARAOMATIC AND MEDICNAL PLANTS	
AMP 1	Exploration, conservation and evaluation of germplasm	0
AMP 2	Genetic improvement for yield and quality	0
AMP 3	Nursery and agro techniques in Medicinal & Aromatic Plants	0
AMP 4	Management of pest and diseases in Medicinal & Aromatic Plants	0
AMP 5	Post-harvest technology, value addition and product development	0
AMP 6	Chemical characterization and quality studies in medicinal and aromatic plants and their products	0
AMP 7	Economics and marketing of Medicinal & Aromatic Plants	0
	PC GROUP 8: BIOTECHNOLOGY, BIOCHEMISTRY & PLANT PHYSIOLOGY	
BBBP 1	Plant Tissue Culture for 1. Micro propagation of recalcitrant species and commercially important crops 2. Crop improvement 3. Secondary metabolite production	0
BBBP 2	Molecular characterization, diversity analysis and Marker Assisted Selection .	0
BBBP 3	Genome mapping, gene annotation and genetic transformation	0
BBBP 4	Genome, Transcriptome, proteome metabolome and phenome analysis	1
BBBP 5	Bioinformatics resources and applications in agriculture	0
BBBP 6	Nano biotechnology and molecular diagnostics	0
BBBP 7	Physiology of crops in precision farming/protected cultivation/organic farming/aerobic system and tissue culture	0
BBBP 8	Physiological approaches for increasing crop productivity and stress tolerance	0
BBBP 9	Physiological basis of crop response and resilience to climate change	1
BBBP 10	Biochemical basis and characterization of 1. Important disorders / diseases in crop plants 2. Agroproducts / New phytocompounds / Biomolecules	0
BBBP 11	Integrated biotechnology- Integration of Plant Biotechnology with industrial, environmental, animal, medical, food, algal biotechnology and metagenomics	0
BBBP12	Somatic embryogenesis in black pepper	0

	PC GROUP 9: SOIL HEALTH AND ORGANIC FARMING	
SHOF 1	Basic Studies on Soils	0
SHOF 2	Soil Fertility evaluation and nutrient management for sustaining soil health and yield maximization	1
SHOF 3	Plant nutrition and nutrient use efficiency	0
SHOF 4	Nutrient management in high tech agriculture and soilless media	0
SHOF 5	Natural Resource management for sustainable development and resource conservation	0
SHOF 6	Characterization and management of constrained/ problem soils.	0
SHOF 7	Waste management for improving soil health and productivity	1
SHOF 8	Environmental pollution and remediation measures	0
SHOF 9	Organic farming and good agricultural practices for soil health and safe food production	1
SHOF 10	Soil ecology and ecosystem conservation	0
SHOF 11	Utilisation of non-conventional forages	0
SHOF 12	Urban and peri-urban cropping/ farming systems	0
	PC GROUP 10: FARMING SYSTEM RESEARCH AND CLIMATE STUDIES	
FSRCS 1	Cropping systems research	0
FSRCS 2	Multi-enterprise farming systems/Homestead Farming	0
FSRCS 3	Urban and peri-urban cropping/ farming systems	0
FSRCS 4	Conservation agriculture	0
FSRCS 5	Integrated resource management in cropping/farming systems	0
FSRCS 6	Component interactions in cropping/farming systems	0
FSRCS 7	Agroecological characterization and watershed research	0
FSRCS 8	System based precision farming	0
FSRCS 9	Crop weather studies, meteorological parameter interactions and forecasting/simulation models	1
FSRCS 10	Climate resilient agriculture/climate change adaptation studies	0
FSRCS 11	Ocean – climate interactions and animal response studies	0
	PC GROUP 11: CROP PESTS AND BENEFICIAL INSECTS	
CPBI 1	1.Ecology and Biosystematics 1. Morphological characterization and documentation of insect pests/ natural enemies and non-insect pests of important crops 2. Molecular systematics for identification of crop pests and natural enemies 3. Exploration and collection of Insect and non-insect biodiversity	0
CPBI 2	2. Climate change and changing pest scenario 1. Pest surveillance, short term and long term forecasting of pests	0

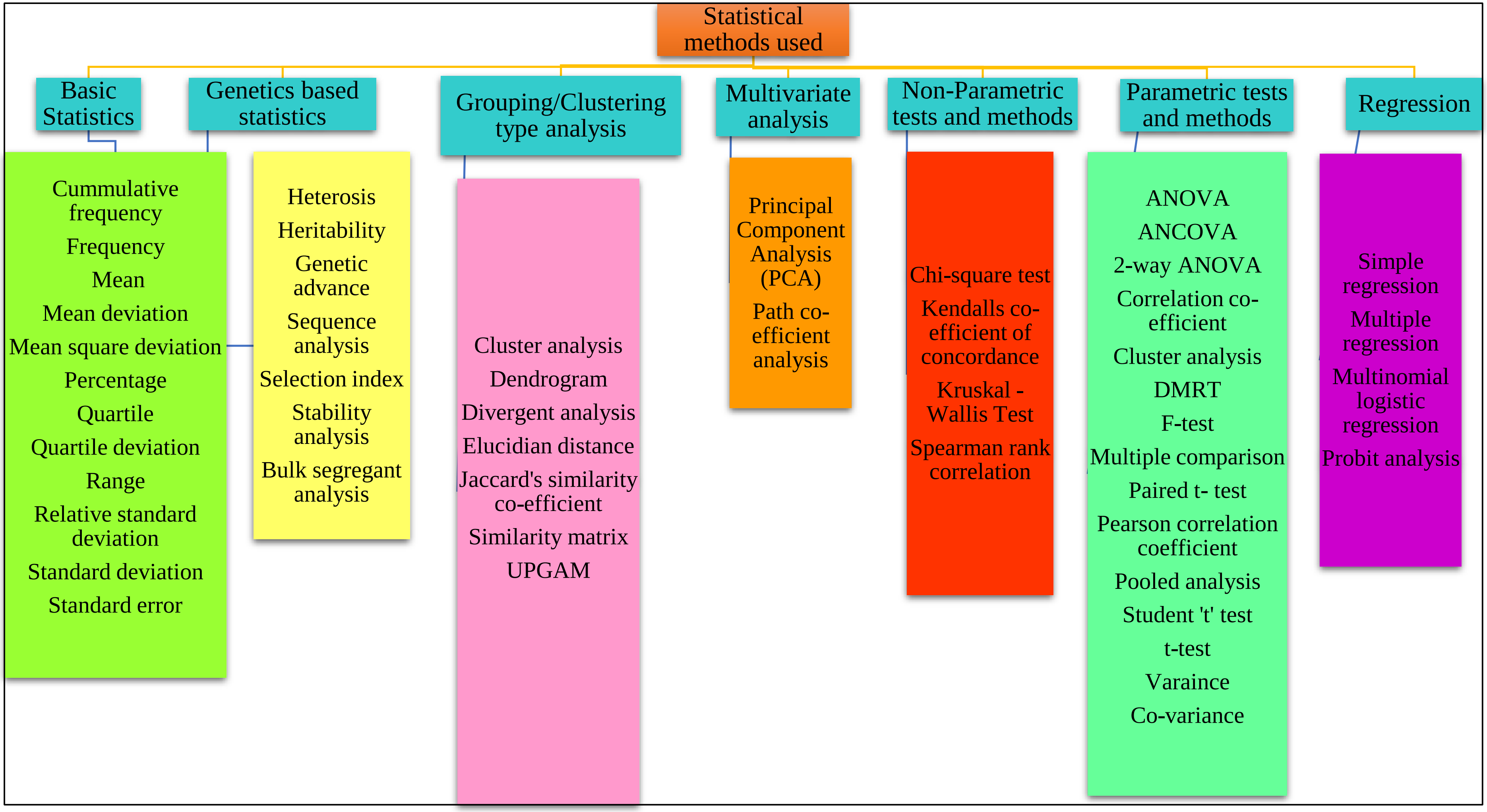
	2. Population dynamics of crop pests in relation to weather parameters 3. Change in pest status and modes of attack	
CPBI 3	3. Strategy for Pest management 1. Estimation of crop loss and data base generation 2. Eco-friendly methods of pest control & Ecological Engineering 3. Chemical interventions 4. Screening germplasm of major crops for resistance to pests, identification of resistance mechanisms including biotechnological approaches 5. Chemical ecology 6. Pest management under protected cultivation and High Tech Agriculture 7. Vector plant interaction 8. Spatial distribution, invasion dynamics and management of newly emerging and alien pests 9. Post-harvest Entomology X	0
CPBI 4	4. Pesticide toxicology 1. Monitoring pesticide residues in crops and environment and its management 2. Impact of pesticides on non-target organisms 3. Bio efficacy and chemo dynamics of pesticides 4. Nanotechnology in pesticide formulations 5. Insecticide resistance and its management	1
CPBI 5	5. Biological Control of Insects, Non insect pests and weeds 1. Potential indigenous natural enemies 2. Formulation technologies of bio pesticides and bio herbicides 3. Conservation techniques of bio control agents under field conditions 4. Studies on in-vitro production for obligate entomopathogens using cell line culture and molecular tools 5. Studies on multiple tolerant bio control agents and entomopathogens 6. Tritrophic interactions X	9
CPBI 6	6. Apiculture 1. Honey bees for pollination of different crops in field and polyhouses 2. Location specific research on bee management 3. Quality control and value addition of honey 4. Cataloguing of floral calendar 5. Meliponiculture X	0
CPBI 7	7. Non-insect pests (mites, nematodes, rodents, birds, snail and slugs) 1. Population dynamics of depredatory birds and its conservation management	0

	2. Beneficial birds 3. Rodents and other Vertebrate pest management	
CPBI 8	8. Insects as Bioresources 1. Medicinal and edible insects 2. Insects as indicators of water pollution	0
CPBI 9	9. Molecular approaches in Entomological Research 1. DNA fingerprinting to study population structure, biotype studies and monitoring genetic changes in insect pest population 2. Mapping of insecticide resistant genes in insects	0
CPBI 10	Beneficial insects (Honey bees)	0
CPBI 11	Alternate methods for managing insects, pest, diseases, nematodes and weeds as a substitute to banned chemicals in Kerala	0
	PC GROUP 12: PLANT PATHOGENS AND BENEFICIAL MICROBES	
PPBM 1	Detection, identification, characterization, molecular and Nano technological studies of plant pathogens and beneficial micro-organisms for crop nutrition, crop protection and microbial biotechnology	0
PPBM 2	Development of novel strategies, beneficial microbes, their improved strains and biomolecules for ecofriendly management of crop diseases, crop nutrition, crop growth enhancement and biocontrol of weeds	0
PPBM 3	Development of efficient microbial formulations and delivery systems for enhanced crop production and protection	0
PPBM 4	Post-harvest and seed borne diseases, mycotoxins and their management	0
PPBM 5	Crop loss assessment, disease mapping, epidemiological aspects and integrated management of major and emerging diseases of crop plants of Kerala	0
PPBM 6	Mushroom production technology and its application in biodegradation, nutraceuticals and pharmaceuticals	1
PPBM 7	Molecular basis of beneficial microbial associations and host-pathogen interaction	0
PPBM 8	Role of plant nutrition and climate change in the development and management of plant diseases	0
PPBM 9	New generation fungicides, development of fungicidal resistance, non -target effects, compatibility and role of residues with respect to food safety and environmental concerns	0
PPBM 10	Exploitation of microbes for bioremediation, biological waste management and waste water recycling.	0
	PC GROUP 13: POST HARVEST TECHNOLOGY	
	A. Postharvest management	
PHT 1	Postharvest management in major and minor crops	0
PHT 2	Pre- harvest factors affecting post-harvest quality	0
PHT 3	Utilisation of microbial agents in post-harvest management	0

PHT 4	Application of biotechnology in post-harvest management	0
PHT 5	Post-harvest management in organic crops	0
	B. Processing and value addition	
PHT 6	Processing and value addition	0
PHT 7	Packaging and storage of processed commodities	0
PHT 8	Bioactive compounds and development of functional foods	0
PHT 9	Waste utilisation	0
PHT 10	Development of novel, organic and convenient food product	0
PHT 11	Quality control studies	0
	PC GROUP 14: FOOD SCIENCE AND NUTRITION	
FSN 1	Food security, food consumption pattern and nutritional status	0
FSN 2	Nutritional problems of the community	1
FSN 3	Quality evaluation of foods & Food products	0
FSN 4	Food Processing, Value addition and product diversification in foods	0
FSN 5	Diet in Health and Diseases	0
FSN 6	Bio active components in foods – Antioxidants and phytochemicals	1
FSN 7	Food hygiene and safety	0
FSN 8	Bio waste utilization	0
FSN 9	Traditional foods - in changing food habits	0
FSN 10	Toxicological studies in foods and food products	0
FSN 11	Wellness foods /Functional Foods/Nutraceuticals/Probiotics	0
FSN 12	Application soft wares/apps for nutrition education and dietary package	0
FSN 13	Developing regional standards for anthropometric indices	0
FSN 14	Analysis of bio active components in food and food products	0
	PC GROUP 15: AGRICULTURAL ECONOMICS, AGRICULTURAL STATISTICS AND AGRIBUSINESS MANAGEMENT	
	Agricultural Economics	
AESBM 1	Impact assessment of KAU technologies/other programmes	0
AESBM 2	Analysing International/National/State policies and sensitizing its impact on farm sector	0
AESBM 3	Cost of production and marketing of major crops/inputs/technologies	0
AESBM 4	Natural resources and environmental economics	1
	Agricultural statistics	
AESBM 1	Developing innovative methods for analysing scientific data Agricultural statistics of Kerala and India	0
AESBM 2	Theoretical and applied studies	0
	Agribusiness Management	
AESBM 1	Agribusiness Management Studies	0
AESBM 2	Evaluation of rural financing scenario and financial institutions	0
AESBM 3	Management of co-operatives and group initiatives	0
AESBM 4	Value analysis of Agribusiness	0

AESBM 5	Evaluation of Agricultural and rural development programmes	0
	PC GROUP 16: AGRICULTURAL EXTENSION AND DEVELOPMENT STUDIES	
AEDS 1	Agricultural crisis and policy research	0
AEDS 2	ICT in Agriculture and media studies	0
AEDS 3	Participatory approaches	0
AEDS 4	Innovations and technology management	0
AEDS 5	Subaltern and Gender studies	0
AEDS 6	NRM and sustainable development	0
AEDS 7	Entrepreneurship and skill development	0
AEDS 8	Extension management and development studies	0
AEDS 9	Impact assessment of technologies and refinement	0
AEDS 10	Research on transfer of technologies	0
AEDS 11	Location specific and need based extension strategies, methods and systems in agriculture	0
AEDS 12	Women empowerment and gender analysis in agriculture, SHG approaches for agriculture development, entrepreneurship and skill development	0
	PC GROUP 17: SUGAR CANE AND TUBER CROPS	
	Sugarcane	
STC 1	Developing varieties suitable for different agro climatic situations of Kerala	0
STC 2	Cost effective and input efficient technologies for high yield and quality in sugarcane	0
STC 3	Developing technologies for processing, product diversification and by-products utilisation of sugarcane	0
STC 4	Management of biotic and abiotic stresses in sugarcane	0
STC 5	Mechanization in sugarcane cultivation and harvesting	0
	Tuber crops	
STC 6	Development of high yielding, location specific and pest and disease resistant varieties in tuber crops	0
STC 7	Development of package of practices including organic package of practices in tuber crops	0
STC 8	Eco-friendly technologies for plant protection with special emphasis on vertebrate pests and virus diseases	0
STC 9	Development of technologies for large scale production of planting materials of tuber crops	0
STC 10	Utilisation of underexploited tuber crops	0

APPENDIX III



Classification of statistical methods

APPENDIX IV

i. Distribution of Crop Production theses based on source of citations

Sl.No.	Source	Agronomy n=14		SSAC n=8		Horticulture n=11		Total N=33	
		f	%	f	%	f	%	f	%
1	Journals	3442	70.36	2288	72.82	3864	76.38	9594	73.28
2	Books	456	9.32	273	8.7	285	5.63	1014	7.75
3	Proceedings	180	3.68	104	3.31	82	1.62	366	2.79
4	M.Sc. Theses	227	4.64	166	5.28	393	7.77	786	6.00
5	Ph.D. Theses	120	2.45	46	1.46	208	4.11	374	2.86
6	Newsletter	6	0.12	7	0.22	0	0.00	13	0.09
7	Annual report	22	0.45	3	0.1	6	0.12	31	0.24
8	Report	9	0.18	3	0.1	9	0.18	21	0.16
9	Abstract	26	0.53	9	0.29	24	0.47	59	0.45
10	E resources	148	3.03	27	0.86	32	0.63	207	1.58
11	Monographs	3	0.06	2	0.06	0	0.00	5	0.04
12	Yearbook	2	0.04	1	0.03	0	0.00	3	0.02
13	Research reports	10	0.20	5	0.16	7	0.14	22	0.17
14	Handbook	3	0.06	18	0.57	4	0.08	25	0.19
15	Government publications	27	0.55	27	0.86	18	0.35	72	0.54
16	Paper	10	0.20	7	0.22	1	0.02	18	0.14
17	Manual	15	0.31	5	0.16	4	0.08	24	0.18
18	Encyclopaedia	2	0.04	0	0.00	0	0.00	2	0.01
19	Newspaper	2	0.04	10	0.32	1	0.02	13	0.09
20	Lecture notes	1	0.02	0	0.00	0	0.00	1	0.01
21	Letter	0	0.00	0	0.00	0	0.00	0	0.00
22	Statistics	9	0.20	1	0.03	4	0.08	14	0.11
23	Survey	0	0.00	1	0.03	0	0.00	1	0.01
24	Compiled books	108	2.21	110	3.50	62	1.23	280	2.14
25	Booklet	12	0.25	16	0.51	4	0.08	32	0.25
26	Technical bulletin/series	30	0.61	4	0.13	27	0.53	61	0.47
27	Working paper	4	0.08	2	0.06	0	0.00	6	0.05
28	Discussion paper	2	0.04	0	0.00	1	0.02	3	0.02
29	Leaflets	0	0.00	0	0.00	1	0.02	1	0.01
30	CD ROM	0	0.00	0	0.00	0	0.00	0	0.00
31	Patent	0	0.00	0	0.00	1	0.02	1	0.01
32	Pamphlet	0	0.00	0	0.00	0	0.00	0	0.00
33	Document	0	0.00	0	0.00	0	0.00	0	0.00
34	B .Sc. thesis	1	0.02	0	0.00	0	0.00	1	0.01
35	Factsheet	0	0.00	0	0.00	0	0.00	0	0.00
36	Others	15	0.31	7	0.22	21	0.42	43	0.33
	Total	4892	100	3142	100	5059	100	13093	100

ii. Distribution of Crop Protection theses based on source of citations

Sl.No.	Source	Plant Pathology n=6		Agricultural Entomology n=6		Total N=12	
		f	%	f	%	f	%
1	Journals	2080	75.61	1481	80.14	3561	77.43
2	Books	200	7.27	72	3.89	272	5.92
3	Proceedings	89	3.24	33	1.78	122	2.65
4	M.Sc. Theses	120	4.37	58	3.14	178	3.88
5	Ph.D. Theses	32	1.16	66	3.57	98	2.13
6	Newsletter	1	0.04	7	0.38	8	0.17
7	Annual report	11	0.31	16	0.87	27	0.58
8	Report	14	0.51	7	0.38	21	0.46
9	Abstract	13	0.48	11	0.6	24	0.52
10	E resources	69	2.51	17	0.92	86	1.87
11	Monographs	1	0.04	1	0.05	2	0.04
12	Yearbook	0	0	0	0	0	0
13	Research reports	6	0.21	5	0.27	11	0.24
14	Handbook	9	0.33	3	0.16	12	0.26
15	Government publications	5	0.2	10	0.54	15	0.33
16	Paper	0	0	0	0	0	0
17	Manual	5	0.2	6	0.33	11	0.24
18	Encyclopaedia	0	0	0	0	0	0
19	Newspaper	4	0.15	2	0.11	6	0.13
20	Lecture notes	3	0.11	0	0	3	0.07
21	Letter	3	0.11	3	0.16	6	0.13
22	Statistics	0	0	1	0.05	1	0.02
23	Survey	0	0	2	0.11	2	0.04
	Compiled books	49	1.78	33	1.79	82	1.79
24	Booklet	8	0.3	0	0	8	0.17
25	Technical bulletin/series	17	0.62	14	0.76	31	0.67
26	Working paper	0	0	0	0	0	0
27	Discussion paper	1	0.04	0	0	1	0.02
28	Leaflets	0	0	0	0	0	0
29	CD ROM	0	0	0	0	0	0
30	Patent	1	0.04	0	0	1	0.02
31	Pamphlet	0	0	0	0	0	0
32	Document	0	0	0	0	0	0
33	B .Sc. thesis	1	0.04	0	0	1	0.02
34	Factsheet	0	0	0	0	0	0
35	Others	9	0.33	0	0	9	0.2
	Total	2751	100	1848	100	4599	100

iii. Distribution of Crop Improvement theses based on source of citations

Sl. No.	Source	Plant physiology n=5		PBG n=14		PBT n=2		Total N=20	
		f	%	f	%	f	%	f	%
1	Journals	1724	85.43	4870	84.31	877	90.97	7471	85.30
2	Books	68	3.37	231	3.99	30	3.11	329	3.77
3	Proceedings	60	2.97	94	1.62	7	0.73	161	1.84
4	M.Sc. Theses	25	1.24	219	3.79	12	1.24	256	2.92
5	Ph.D. Theses	9	0.44	98	1.70	2	0.21	109	1.24
6	Newsletter	0	0.00	14	0.24	0	0	14	0.16
7	Annual report	4	0.20	9	0.16	0	0	13	0.15
8	Report	3	0.15	8	0.14	0	0	11	0.13
9	Abstract	2	0.10	12	0.21	14	1.45	28	0.32
10	E resources	14	0.69	34	0.59	1	0.10	49	0.56
11	Monograph	12	0.60	0	0	0	0	12	0.14
12	Yearbook	0	0.00	0	0	1	0.10	1	0.01
13	Research reports	0	0.00	5	0.09	0	0	5	0.06
14	Handbook	3	0.15	6	0.10	2	0.21	11	0.13
15	Government publications	13	0.64	22	0.38	0	0	35	0.40
16	Paper	0	0.00	2	0.03	0	0	2	0.02
17	Manual	1	0.05	5	0.09	0	0	6	0.07
18	Encyclopaedia	0	0.00	0	0	0	0	0	0.00
19	Newspaper	1	0.05	0	0	0	0	1	0.01
20	Lecture notes	0	0.00	8	0.14	0	0	8	0.09
21	Letter	1	0.05	0	0	0	0	1	0.01
22	Statistics	0	0.00	10	0.17	0	0	10	0.11
23	Survey	3	0.15	0	0	0	0	3	0.03
24	Compiled books	66	3.27	112	1.94	7	0.73	185	2.11
25	Booklet	4	0.20	1	0.02	3	0.31	8	0.09
26	Technical bulletin/series	2	0.10	8	0.14	2	0.21	12	0.14
27	Working paper	0	0.00	0	0	0	0	0	0.00
28	Discussion paper	0	0.00	0	0	0	0	0	0.00
29	Leaflets	0	0.00	0	0	0	0	0	0.00
30	CD ROM	0	0.00	0	0	0	0	0	0.00
31	Patent	0	0.00	0	0	1	0.10	1	0.01
32	Pamphlet	0	0.00	1	0.02	1	0.10	2	0.02
33	Document	0	0.00	0	0	0	0	0	0.00
34	B .Sc. thesis	0	0.00	0	0	0	0	0	0.00
35	Factsheet	0	0.00	1	0.02	3	0.31	4	0.05
36	Others	3	0.15	6	0.11	1	0.10	10	0.11
	Total	2018	100	5776	100	964	100	8759	100

iv. Distribution of Social Science theses based on source of citations

Sl. No.	Source	Agricultural economics n=1		Agricultural extension n=4		Total N=5	
		f	%	f	%	f	%
1	Journals	106	41.73	507	52.38	613	50.16
2	Books	27	10.63	82	8.47	109	8.92
3	Proceedings	9	3.54	24	2.48	33	2.70
4	M.Sc. Theses	30	11.81	65	6.71	95	7.77
5	Ph.D. Theses	10	3.94	77	7.96	87	7.12
6	Newsletter	0	0	2	0.21	2	0.16
7	Annual report	0	0	0	0	0	0
8	Report	4	1.57	10	1.03	14	1.15
9	Abstract	0	0	4	0.41	4	0.33
10	E resources	16	6.30	83	8.57	99	8.10
11	Monographs	0	0	0	0	0	0
12	Yearbook	0	0	0	0	0	0
13	Research reports	7	2.75	1	0.10	8	0.65
14	Handbook	2	0.79	2	0.21	4	0.33
15	Government publications	8	3.15	27	2.79	35	2.86
16	Paper	2	0.79	7	0.72	9	0.74
17	Manual	0	0	6	0.62	6	0.49
18	Encyclopaedia	0	0	1	0.10	1	0.08
19	Newspaper	0	0	1	0.10	1	0.08
20	Lecture notes	0	0	4	0.41	4	0.33
21	Letter	0	0	0	0	0	0
22	Statistics	0	0	2	0.21	2	0.16
23	Survey	2	0.79	3	0.31	5	0.41
	Compiled books	4	1.57	21	2.17	25	2.05
24	Booklet	0	0	5	0.52	5	0.41
25	Technical bulletin/series	13	5.12	2	0.21	15	1.23
26	Working paper	4	1.58	14	1.44	18	1.47
27	Discussion paper	0	0	5	0.52	5	0.41
28	Leaflets	0	0	3	0.31	3	0.25
29	CD ROM	5	1.97	5	0.52	10	0.82
30	Patent	0	0	0	0	0	0
31	Pamphlet	0	0	0	0	0	0
32	Document	0	0	0	0	0	0
33	B .Sc. thesis	0	0	0	0	0	0
34	Factsheet	0	0	0	0	0	0
35	Others	5	1.97	5	0.52	10	0.82
	Total	254	100	968	100	1222	100

v. Distribution of Community Science theses based on source of citations

Sl.No.	Source	Community science N=4	
		f	%
1	Journals	1846	72.85
2	Books	238	9.40
3	Proceedings	14	0.55
4	M.Sc. Theses	125	4.93
5	Ph.D. Theses	78	3.08
6	Newsletter	4	0.16
7	Annual report	5	0.20
8	Report	29	1.14
9	Abstract	3	0.12
10	E resources	27	1.07
11	Monographs	3	0.12
12	Yearbook	0	0
13	Research reports	0	0
14	Handbook	8	0.32
15	Government publications	45	1.78
16	Paper	3	0.12
17	Manual	5	0.19
18	Encyclopaedia	0	0
19	Newspaper	2	0.08
20	Lecture notes	0	0
21	Letter	4	0.16
22	Statistics	8	0.32
23	Survey	5	0.19
	Compiled books	20	0.79
24	Booklet	11	0.43
25	Technical bulletin/series	12	0.47
26	Working paper	14	0.55
27	Discussion paper	1	0.04
28	Leaflets	0	0
29	CD ROM	0	0
30	Patent	0	0
31	Pamphlet	0	0
32	Document	3	0.11
33	B .Sc. thesis	0	0
34	Factsheet	1	0.04
35	Others	20	0.79
	Total	2534	100

APPENDIX V

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE, VELLAYANI- 695 522

Questionnaire

(For Students)

Research trends and academic research productivity of Ph.D. dissertations in Kerala Agricultural University

1. Name of students (Mr./Ms.):

2. Class (year of study):

3. Department:

4. Gender(Male/Female):

5. Your Locality area(Village/Town/City):

6. Family details:

Sl.No.	Family	Age	Educational Qualifications	Occupation	Income per annum (in Rs. Lakhs)
1	Father				
2	Mother				
3	Brother				
4	Sister				
5	Others				

7. Educational Qualifications:

Class of study	Name of school /college	G/AP/UP	SSLC/CBSE/ ICSE/Discipline	Medium of instruction English(E)/ Vernacular (V)
10^{th} Class				
12^{th} Class				
Under graduate				
Post graduate				
Ph.D.				

Any other specify				

(G-Government, AP-Aided private, UP-Unaided private)

8. Attitude towards research:

Rank your attitude towards research according to 5 point Likert scale. Place a tick mark against the statements based on your degree of agreement that ranges from 1-5 where a score of 1 indicates 'strongly disagree' and 5 indicate 'strongly agree'.

	Statements	**SA**	**A**	**UN**	**DA**	**SDA**
1	Research is connected to my field of study and its useful for my career					
2	Research should be indispensable in my professional training					
3	Research should be taught to all students					
4	The skills I have acquired in research will be helpful to me in the future and will employ research approaches in my profession					
5	I love and enjoy doing research					
6	I am interested in research					
7	Most students benefit from research					
8	I am inclined to study the details of research					
9	Research makes me nervous					
10	Research for me is complex and stressful					
11	Research makes me anxious					
12	I feel insecure concerning the analysis of research data					
13	I aim to use research in my daily life					
14	Research-orientated thinking will help me in my professional life					
15	Research thinking does not apply to my personal life					
16	Research is irrelevant to my life					
17	I have trouble with arithmetic					
18	I find it difficult to understand the concepts of research					
19	I make many mistakes in research					
20	Research is difficult and complicated					

(SA- Strongly Agree, A- Agree, UN- Undecided, DA-Disagree, SDA- Strongly Disagree)

9. Research skills:

Following are statements reflecting the research skills in terms of a) information seeking skills and b) methodology skills c) problem solving skills d) statistical/analytical skills e) communication skills f) universal outcomes. Please tick

(√) the relevant boxes based on your perception as to the degree of agreement on the statements given below.

a) Information seeking skills

Statements	SA	A	UN	DA	SDA
I am aware that information found in journals are more often checked, edited and criticized compared to information found in magazines					
I am aware that information can be obtained through various means (e.g., electronic media, images, audio and video)					
I am aware that the secondary source is the source that discusses the work of others					
I identify and look for synonyms, themes or key words that can be used to find information based on my topic					
In order to find information, I read general texts like dictionaries or encyclopedia articles to gain more understanding on the terminologies used in my topic					
I am confident that I can find a book based on the title given					
I will look at alternative options to find out information again in order to get exactly what I want if it is not successful the first time					
I evaluate the accurateness of the content by reading other sources mentioned by the writer					
I realize that time is a factor that influences the relevance of the information to my topic of research					
When searching for information, I arrange each item systematically					
I write down the important concepts myself using my own words					

b) Methodology skills

Statements	VP	P	NVP	SA	VSA
I have the ability to plan a research					
I have the knowledge and ability to develop a research question					
I have the ability to search for a research problem					
I have the ability to do a comprehensive review of literature					
I have the knowledge and skill to design a scientific experiment study					
I have the knowledge in selecting the appropriate instrument					

I have the knowledge and skill to develop an appropriate instrument					
I have the required skills in collecting survey data					
I have the ability to write an abstract					
I have the preparing a manuscript for publication					
I have the knowledge and skill to choose the correct and appropriate method for analysis of data					
I have the ability to interpret the results of a research study and draw correct inferences					

VP- Very poor, P-Poor, NVP-Not very poor, SA-Satisfactory, VSA-Very satisfactory)

c) Problem solving skills

Statements	SA	A	UN	DA	SDA
I have ability to apply scientific methods in the process of identifying the components of research					
Before finalizing the research topic, I use scientific methods to describe the cause-effect of components of the research problem logically and relevantly					
I have ability to draw conclusions and analyse the influence of research outcome					
I have the confidence and ability to weigh one solution against another with reasoning skills					
I usually take feedback from peers and superiors and reflect on the results of research outcomes					

d) Statistical/analytical skills

Statements	SA	A	UN	DA	SDA
I am more interested in qualitative methods rather than quantitative methods in research					
It is difficult to understand statistical procedures					
I am confident in using statistical procedures					
I know how to prepare spreadsheets models/ use MS excel to store the data					
I can create, calculate, analyse, interpret and present statistical measurements from data sets					
I can manipulate and analyse quantitative data using common probability distributions and statistical functions					
I can perform data analysis accurately by using MS Excel or R programme or SPSS package or other appropriate tools					

I can construct hypothesis and analyse test of significance with proper parametric or non- parametric tests					
I have ability to work/interpret with graphs, figures, tables, illustrations, etc., to present results more convincing					
I found lectures on data analysis and other descriptive statistics useful during my coursework					

e) Communication skills

Statements	**SA**	**A**	**UN**	**DA**	**SDA**
I am able to write review of literature, methodology, results and discussion with minimum or without plagiarism					
I am able to write thesis by adhering to research guidelines accurately					
I am able to do a research presentation with confidence					
I am able to speak the local language to gather information and communicate with respondents or other relevant people					
I have ability to ask questions to respondents and explain the purpose, objectives, conclusions of the research					
I am able to tailor the communication to the needs and knowledge level of a particular audiences					
Participation in seminars and conferences improves my confidence in presenting the outcomes of research					
I have the ability to write scholarly articles for high refereed journals					
I have ability to speak as well as give feedback in English confidently while presenting the research outcome					

f) Universal outcomes

Statements	**SA**	**A**	**UN**	**DA**	**SDA**
I have ability to think creatively/synthetically					
I have ability to think critically/logically to solve problem					
I can control emotions well while conducting research					
I am not a passive recipient of information but a participant in creation of understanding					
I have knowledge to determine the correct sample size of study, to define the correct no. of treatments and replications, to select appropriate research design					

10. Whether all the required source of information is available on the subject of research (Yes/No).

If Yes; to what extent - [Very much/ Much/ Not Much]

11. Whether all facilities and equipment are available in doing research? (Yes/No).

If Yes; to what extent- [Very much/ Much/ Not Much]

12. Whether raw materials are available for the research on time? (Yes/No).

If Yes; to what extent [Very much/ Much/ Not Much]

13. Whether funds and other privileges are available upon upgradation or on time? (Yes/No).

If Yes; to what extent [Very sufficient / sufficient/ not sufficient]

14. Is there any difficulty in timely attainment of raw materials? (Yes/No).

If Yes; to what extent [Very difficult / difficult/ less difficult]

15. Whether there is any difficulty in finding proper review of literature? (Yes/No).

If Yes; to what extent [Very difficult / difficult/ less difficult]

16. Is there any difficulty in attaining raw materials for research? (Yes/No)

If Yes; to what extent [Very difficult / difficult/ less difficult]

17. Is there any difficulty in attaining funds for research? (Yes/No).

If Yes; to what extent [Very difficult / difficult/ less difficult]

18. Did you get any help from your classmates or friends [Yes/No].

If Yes, to what extent [Very Much/ Much/ Not Much]

19. What was the extent of contribution of teachers for your research work?

Teachers	**Very much**	**Much**	**Not much**
Chairman			
Advisory committee members			
Other non-members			

20. What was the extent of contribution of Departments in general for your research work?

Department	Very much	Much	Not much
Own department			
Other department			

21. Are you satisfied with your research (Yes/No).

If Yes; to what extent [Very much/ Much/ Not Much]

22. Have you published any research works? (Yes/No)

If yes; in which journals

………………………………………………………….

23. How much difficult is it to be published? [Very Difficult (1)/ Difficult (2)/ Not Difficult (3)]

- If difficult specify the difficulty with reasons:

24. How is the research work environment? Is it workable (Yes/No).

If Yes; to what extent [Very much/ Much/ Not Much]

25. Please identify 5 journals you believe are the premier research journals for agriculture

26. What do you believe are the top five Research Themes to be focused currently in the field of agriculture

27. 'The research themes framed by our University for your department are adequate and currently addresses the problems of Kerala Agriculture'. Please assign a weightage on 10 for the statement. (-------/10)

28. Enlist at least 3 gaps in agricultural research

…………………………………………………………………………….

…………………………………………………………………………….

…………………………………………………………………………….

29. Enlist 5 main constraints you face in doctoral research in agriculture

…………………………………………………………………………….

…………………………………………………………………………….

………………………………………………………………………………

APPENDIX VI

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE, VELLAYANI- 695 522

Questionnaire

(For Teachers)

Research trends and academic research productivity of Ph.D. dissertations in Kerala Agricultural University

1. Name of Teacher (Mr. /Ms. /Dr.):

2. Discipline:

3. Permanent address:

4. Married/Unmarried:

5. Age:

6. Qualifications (please specify):

Degree	KAU	OTHER (Please mention state)	Year of completion
M.Sc.			
Ph.D.			
Post Doctorate			
Any other specify			

7. Date of entry into service in KAU:

8. In which year of your service you started guiding:

9. Number of students has guided/guiding previously: Ph.D. ----

10. Number of students currently guiding: Ph.D. ----

11. Number of students who published their research work: Ph.D. ---

12. Total number of paper published by student: Ph.D. ---

13. Number of Externally Aided Projects: As PI-----------(Excluding Plan Projects)

Please tick (√) mark the relevant boxes on scale below

14. a. Whether all resources needed are available to Ph.D. students? Yes/No

b. Whether there is any difficulty in attaining resources for Ph.D. students? Yes/No

S.No.	**Item**	**a. If Yes, the extent of availability**			**b. If Yes, extent of difficulty in attaining**		
		VMA	**A**	**LA**	**VD**	**D**	**LD**
1	Literature						
2	Research materials						
3	Raw materials						
4	Funds and other privileges						

(VMA- Very much available; A-Availability; LA- Less availability; VD-Very difficult; D-Difficult; LD- Less difficult)

15. Whether cost allocation is sufficient for conducting Ph.D. research? Yes/No

If Yes; to what extent is it sufficient- [Very sufficient/ Sufficient/ Less Sufficient]

16. Whether students under your guidance do possess the following research skills?

S.NO.	**Research skills**	**Very Much**	**Much**	**Not Much**
1	Information seeking skills			
2	Methodology skills			
3	Problem-solving skills			
4	Statistical/Quantitative analytical skills			
5	Communication skills			
6	Universal outcomes			

17. Please rate the ability of your PhD students in general to conduct research on the following:

Statement	**VP**	**P**	**NVP**	**SA**	**VSA**
Ability to plan a research					
Knowledge and ability to develop a research question					
Ability to search for a research problem					
Ability to do a comprehensive review of literature					
Knowledge and skill to design a scientific experiment study					
Knowledge in selecting the appropriate instrument					
Knowledge and skill to develop an appropriate instrument					
Required skills in collecting survey data					
Ability to write an abstract					

Preparing a manuscript for publication					
Knowledge and skill to choose the correct and appropriate method for analysis of data					
Ability to interpret the results of a research study and draw correct inferences					

(VP- Very poor; P- Poor; NVP-Not very poor; SA-Satisfactory; VSA-Very satisfactory)

18. Please rate the students' attitude* towards research according to you in following statements:

Attitude* - Positive or negative mental predisposition of the students towards research

S.NO.	Statements	SA	A	UD	D	SDA
1	Research should be taught to all students					
2	Skills they acquired in research will be helpful to them in future and will employ research approaches in their profession					
3	Most students benefit from research					
4	Research for students is complex and stressful to them					
5	They feel insecure concerning the analysis of research data					
6	Research thinking does not apply to student’s personal life					
7	They find it difficult to understand the concepts of research					
8	They make many mistakes in research					
9	Research is difficult and complicated					
10	Research-orientated thinking will help in their professional life					

(SA- Strongly agree; A-Agree; UN-Undecided; D-Disagree; SDA-Strongly disagree)

19. Please identify 5 journals you believe are the premier research journals for agriculture or your department

…………………………………………………………………………………….

…………………………………………………………………………………….

20. What do you believe are the top five Research Themes to be focused currently in the field of agriculture?

……………………………………………………………………………………..

…………………………………………………………………………………......

21. ‘The research themes framed by our University for your department are adequate and currently addresses the problems of Kerala Agriculture’. Please assign a weightage on 10 for the statement. (-------/10)

22. Enlist at least 3 gaps in agricultural research according to you

………………………………………………………………………………

………………………………………………………………………………

23. Enlist at least 5 main constraints students face in doctoral research in agriculture

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

24. What will be your suggestions to overcome the perceived constraints?

…………………………………………………………………………………………

…………………………………………………………………………………………

25. Please be free to render any additional comments to improve the quality of PhD research in our university

…………………………………………………………………………………………..

…………………………………………………………………………………………..

…………………………………………………………………………………………..

26. Any comments:

APPENDIX VII

Check List for content analysis of PhD research theses:

1. Title
    - Crop or area focused
2. Thrust area

Year	PC Group	Thrust Area	No. of Thesis
Total			

- Total no. of thrust areas
- Total no. of thrust areas excluded

3. Number of objectives
4. References
    - No. of references in each thesis
    - References categorisation based on years

Sl.No.	Year
1	Earlier than 1900
2	1901-1925
3	1926-1950
4	1951-1975
5	1976-2000
6	After 2000

5. Research methodology adopted
    - Sample size
    - Sampling method used
    - Research design
    - Statistical methods used
    - No. of independent variables

Check List for Academic Research Productivity

1. Proportion published
    - Total number of papers published
    - Papers in high refereed journals under each thesis

Category	Frequency
NAAS rated journals	
UGC care list	
Copernicus index	
Scopus index	
Google scholar	
Other index	

2. Proportion cited

- Bibliographic form wise distribution of citations

    - Citations based on year

Sl.No.	Year
1	Earlier than 1900
2	1901-1930
3	1931-1960
4	1961-1990
5	After 1991

    - Citations based on their source or type of publication

- Journals
- Books
- Proceedings
- Ph.D. theses
- M.Sc. theses
- Newsletter
- Annual report
- Report
- Abstract
- E resources
- Monographs
- Yearbook
- Research reports
- Handbook
- Government publications
- Paper
- Manual
- Encyclopaedia
- Newspaper
- Lecture notes
- Letter
- Statistics
- Survey
- Compiled books
- Booklet
- Technical bulletin/series
- Working paper
- Discussion paper
- Leaflets
- CD ROM
- Patent
- Pamphlet
- Document
- B.Sc. theses
- Factsheet
- Others

- Geographic form wise distribution
- Average number of citations per dissertation

Abstract

RESEARCH TRENDS AND ACADEMIC RESEARCH PRODUCTIVITY OF Ph.D. DISSERTATIONS IN KERALA AGRICULTURAL UNIVERSITY

by

MUPPIDI SPANDITHA

(2019-11-214)

ABSTRACT

Of the thesis submitted in partial fulfilment of

the requirement for the degree of

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANATHAPURAM-695522

KERAL, INDIA

2022

ABSTRACT

The study entitled "Research trends and academic research productivity of Ph.D. dissertations in Kerala Agricultural University" was undertaken in the year 20120-21. The main objectives were assessment of research pattern and productivity of the Ph.D. research in terms of proportion published or cited. The study explored determinants of Ph.D. students' research efficiency as perceived by the teachers and constraints and suggestions as perceived by students and teachers in the conduct of doctoral research will also be studied. The entire PhD theses submitted to College of Agriculture, Vellayani for the five years from 2015-2019 were enumerated, categorized under different divisions and will be subjected to qualitative content analysis. A total of 80 respondents comprising of 50 students and 30 teachers were selected for the study.

During 2015- 2019, crop production division has maximum number of theses (33) submitted and overall theses submitted were maximum (24) during 2017. The result on content pattern of PhD research was conducted based on various parameters. In terms of crops/areas focused, majority (20.27%) of studies were concentrated on cereals (rice), followed by vegetables (14.87%), fruits (13.51%), and tuber crops (8.11%). For the period 2011-2014, 19 PC groups had 80 per cent or more untouched thrust areas 100 per cent of these belonged to Spices and Plantation Crops (SPC), Pulses and Oil Seeds (POS), Forage and Green Manure Crops (FGM), Gender studies (GS) and Agro-Economic Studies (AES). During 2015-2017, 14 PC groups were found to have 80 per cent or more untouched areas among which Floriculture (FL), Post-Harvest Technology (PHT), Sugar and Tuber Crops (STC) groups had 100 per cent of untouched areas. It was observed that over the years' number of thrust areas decreased but the percentage of untouched areas showed an increasing trend. In case of number of objectives by using quartiles, all divisions showed medium range (2-4) of objectives with 82.43 per cent. On summarisation, majority (32.43%) of studies had two objectives. Overall data based on mean number of references using quartiles indicated that social science theses had low number of references (<223) while remaining divisions had medium range (223-369) of references.

In the studies, 65.07 per cent of theses referred most from 2001 and above. Most commonly used research design among crop production theses was Randomised Block

Design (RBD) with 40.42 per cent, Completely Randomized Design (CRD) with 47.06 per cent in crop protection, RBD and CRD both with 40.91 per cent among crop improvement theses, exploratory research design (60.00%) in social science and CRD and *ex post facto* design both with 50 per cent in community science. With the categorisation of statistical methods under seven categories, majority of the studies in crop production used parametric tests and methods (61.54%), basic statistics (47.72%) in crop protection, Parametric tests and methods (33.33%) in crop improvement, basic statistics (59.26%) in social science and Parametric tests and methods (35.30%) in community science. With reference to sample size, majority (50.00%) of Community Science department theses had less than hundred sample size. However, it was interesting to note that sample size in majority (60.00%) of theses under social science ranged from 201-300 and in remaining all divisions majority of theses had range 101-200. In case of type of sampling methods, majority (40.00%) of the theses conducted studies using random sampling. Under social science division, majority (75.00%) of Agricultural Extension theses studied independent variables ranging from nine to thirty.

Academic research productivity was assessed based on proportion published and cited. On perusal of data, crop production division had published two papers on an average (42.42%) and half of the community science studies had published more than two papers. To summarise, publications less than two accounted the most with 39.19 per cent. Publications in peer reviewed journals were categorised under different indexing lists where it was noted that majority of the publications (82.42%) belonged to National Institute of Agricultural Sciences (NAAS) rated journals followed by Google scholar (12.12%), Copernicus index (2.42%), others (2.42%), University Grants Commission - Consortium for Academic Research and Ethics (UGC-CARE) list (1.21%) and Scopus index (0.61%). Citations distribution based on year showed that majority of theses (84.05%) cited were from 1991 and above whereas based on source it was found that among 35 types of sources identified journals were cited on majority among all divisions. Other types of major sources cited were books, proceedings, Master of Science (M.Sc.) theses, Doctor of Philosophy (Ph.D.) theses and e-resources. Geographic distribution of citations indicated that international publications were cited more compared to national publications among all departments except agricultural extension. Among all departments, average number of citations from national and international publications were cited more in Community Science with 217 and 416 average number respectively. In terms of average number of citations, based on range highest range (272-843) was found in plant breeding and genetics department whereas average number of citations was observed highest in community science department (633) with range of 448-827.

Attitude of students towards PhD research was studied. It was found that 74.00 per cent of students possessed good attitude and only 16.00 per cent of students had very good attitude towards PhD research. About 86.67 per cent of teachers perceived that students possessed good attitude towards research and 13.33 per cent teachers recognised that students had very good attitude towards doctoral research. On the whole in case of perception in adequacy based on research themes, teachers opined that there was 23.4 per cent of gap and students opined 32.20 per cent of gap which currently does not address the problems of Kerala agriculture.

The major constraints in conducting doctoral research as perceived by students were insufficient funds (Rank 1), lack of advanced research facilities and equipments (Rank 2), and insufficient lab facilities (Rank 3). Insufficient lab facilities (Rank 1), lack of advanced research facilities and equipments (Rank 2) and insufficient funds (Rank 3) were perceived as constraints by teachers. In order to overcome the ascertained constraints suggestions as perceived by teachers were provision of central instrumentation facility, increasing contingent grants/funds, participation in external aided projects, exposure of students to advanced methods or equipments, enforcement of research collaborations in interdisciplinary or with other organisations/institutes (national or overseas), giving maximum exposure to students by participating in conferences and seminars (national or international) and also improving students research skills with proper training via lectures or practical classes that enhance their knowledge and skill before conducting research. In order to improve academic research productivity, it is necessary to encourage students in publishing more quality articles in peer reviewed journals with high NAAS ratings (6+ impact factor) and other similar indices and also conducting research with deliverable output through publications which is monitored and reviewed systematically.

സംഗ്രഹം

"കേരള കാർഷിക സർവ്വകലാശാലയിലെ പി.എച്ച്.ഡി പ്രബന്ധങ്ങളുടെ ഗവേഷണ പ്രവണതകളും അക്കാദമിക് ഗവേഷണ കാര്യക്ഷമതയും" എന്ന തലക്കെട്ടിൽ 2020-21 കാലയളവിൽ കൃഷി വിജ്ഞാന വ്യാപന വിഭാഗത്തിൽ പഠനം നടത്തുകയുണ്ടായി. പിഎച്ച്ഡി ഗവേഷണ രീതിയും കാര്യ ക്ഷമതയും വിലയിരുത്തലായിരുന്നു പ്രധാന ലക്ഷ്യങ്ങൾ. പ്രസിദ്ധീകരിച്ചതോ ഉദ്ധരിച്ചതോ ആയ പ്രബന്ധങ്ങളുടെ അനുപാതത്തിന്റെ അടിസ്ഥാനത്തിൽ ഗവേഷണം നടത്തി. പിഎച്ച്ഡി വിദ്യാർഥികളുടെ ഗവേഹഷണ പ്രാപ്തി നിർണ്ണയിക്കുന്ന ഘടകങ്ങളെ പര്യവേക്ഷണം ചെയ്തു. അധ്യാപകർ മനസ്സിലാക്കിയ വിദ്യാർത്ഥികളുടെ ഗവേഷണ കാര്യക്ഷമതയും ഡോക്ടറൽ ഗവേഷണം നടത്തുന്നതിൽ വിദ്യാർത്ഥികളും അധ്യാപകരും മനസ്സിലാക്കുന്ന തടസങ്ങളും നിർദ്ദേശങ്ങളും പഠിക്കുകയുണ്ടായി. 2015-2019 വരെയുള്ള അഞ്ച് വർഷത്തേക്ക് വെള്ളായണി കാർഷിക കോളേജിൽ സമർപ്പിച്ച മുഴുവൻ പിഎച്ച്ഡി തീസിസുകളും എണ്ണിത്തിട്ടപ്പെടുത്തി, വിവിധ വിഭാഗങ്ങളുടെ കീഴിൽ തരംതിരിച്ച് ഗുണപരമായ ഉള്ളടക്ക വിശകലനത്തിന് വിധേയമാക്കി. 50 വിദ്യാർത്ഥികളും 30 അധ്യാപകരും അടങ്ങുന്ന 80 വ്യക്തികളെ ആണ് പഠനത്തിനായി തിരഞ്ഞെടുത്തത്.

വിള ഉൽപ്പാദന വിഭാഗം കാലയളവിൽ ഏറ്റവും കൂടുതൽ 19-2015 പ്രബന്ധങ്ങൾ പ്രബന്ധങ്ങൾ സമർപ്പിച്ചത് (24) സമർപ്പിച്ചതായും പരമാവധി (33) ൽ ആയിരുന്നുവെന്നും രേഖപ്പെടുത്തി2017. പിഎച്ച്ഡി ഗവേഷണത്തിന്റെ ഉള്ളടക്കം വിശകലനം ചെയ്തത് വിവിധ ഘടകങ്ങളെ അടിസ്ഥാനമാക്കിയാണ്. വിളകൾ/ അനുബന്ധ മേഖലകൾ എന്ന വിഭാഗത്തിൽ നടന്ന പഠനങ്ങളിൽ ഭൂരിഭാഗവും (20.27%) കേന്ദ്രീകരിച്ചത് ധാന്യ വിളകൾ (നെല്ല്), തുടർന്ന് പച്ചക്കറികൾ (14.87%), പഴങ്ങൾ (13.51%), കിഴങ്ങുവിളകൾ (8.11%) എന്നിവയിലായിരുന്നു . 2011-2014 കാലയളവിൽ, 19 പിസി ഗ്രൂപ്പുകളിൽ 80 ശതമാനമോ അതിൽ കൂടുതലോ ഗവേഷണം നടത്താത്ത ത്രസ്റ്റ് ഏരിയകളുള്ളതായി കണ്ടെത്തുകയും, ഇതിൽ 100 ശതമാനവും സുഗന്ധവ്യഞ്ജനങ്ങളും തോട്ടവിളകളും (എസ്സിസി), പയറുവർഗ്ഗങ്ങളും എണ്ണ വിത്തുകളും (പിഒഎസ്), തീറ്റ, പച്ചിലവള വിളകൾ (എഫ്ജിഎം) ജെൻഡർ സ്റ്റഡീസ് (GS), അഗ്രോ ഇക്കണോമിക് സ്റ്റഡീസ് (AES) വിഭാഗങ്ങളിൽ പെട്ടതായി കാണപ്പെടുകയും ചെയ്തു. 2015-2017 കാലയളവിൽ, 14 പിസി ഗ്രൂപ്പുകളിൽ 80 ശതമാനമോ അതിൽ കൂടുതലോ സ്പർശിക്കാത്ത മേഖലകളുണ്ടെന്ന് കണ്ടെത്തി. അതിൽ ഫ്ലോറികൾച്ചർ (FL), പോസ്റ്റ്-ഹാർവെസ്റ്റ് ടെക്നോളജി (PHT), മധുര , കിഴങ്ങുവിളകൾ (STC) ഗ്രൂപ്പുകളില് 100 ശതമാനം ഗവേഷണം നടത്താത്ത പ്രദേശങ്ങളുണ്ട്. ത്രസ്റ്റ് ഏരിയകളുടെ എണ്ണം കുറഞ്ഞുവെങ്കിലും ഗവേഷണം നടത്താത്ത പ്രദേശങ്ങളുടെ ശതമാനം വർദ്ധിച്ചുവരുന്ന പ്രവണത കാണിക്കുന്നതായി നിരീക്ഷിച്ചു. ഗവേഷണ ലക്ഷ്യങ്ങളെ ക്വാർട്ടൈലുകൾ ഉപയോഗിച്ച് തരംതിരിച്ചപ്പോൾ , എല്ലാ വിഭാഗങ്ങളിലും മൊത്തത്തിൽ 82.43 ശതമാനം എന്ന നിലയിൽ ഇടത്തരം ശ്രേണി (2-4) കാണിച്ചു. ചുരുക്കത്തിൽ, ഭൂരിഭാഗം പഠനങ്ങൾക്കും (32.43%) രണ്ട് ലക്ഷ്യങ്ങളുള്ളതായി കാണപ്പെട്ടു. ക്വാർട്ടൈലുകൾ ഉപയോഗിച്ചുള്ള റഫറൻസുകളുടെ ശരാശരി എണ്ണത്തെ അടിസ്ഥാനമാക്കിയുള്ള മൊത്തത്തിലുള്ള ഡാറ്റ സൂചിപ്പിക്കുന്നത് സാമൂഹ്യ ശാസ്ത്ര പ്രബന്ധനങ്ങളിൽ റഫറൻസുകളുടെ എണ്ണം കുറവായും (<223) ശേഷിക്കുന്ന വിഭാഗങ്ങളിൽ ഇടത്തരം നിലയിലുള്ള (223-369) റഫറൻസുകളും ഉണ്ടായിരുന്നു എന്നാണ്.

65.07 ശതമാനം പ്രബന്ധനങ്ങളിലും 2001-ലും അതിനുശേഷവും നടന്ന പഠനങ്ങളെ പരാമർശിച്ചവയാണ്. ക്രോപ്പ് പ്രൊഡക്ഷൻ പ്രബന്ധനങ്ങളിൽ

പൊതുവേ റാൻഡമൈസ്ഡ് ബ്ലോക്ക് ഡിസൈൻ (ആർബിഡി) 40.42 ശതമാനം ,വിള സംരക്ഷണ വിഭാഗത്തിൽ കംപ്ലീറ്റ്ലി റാൻഡമൈസ്ഡ് ഡിസൈൻ (സിആർഡി) 47.06 ശതമാനം, വിള മെച്ചപ്പെടുത്തൽ പ്രബന്ധനങ്ങളിൽ ആർബിഡിയും സിആർഡിയും 40.91 ശതമാനം വീതം, സാമൂഹ്യ ശാസ്ത്ര വിഭാഗത്തിൽ പര്യവേക്ഷണ ഗവേഷണം(60.00%), കമ്മ്യൂണിറ്റി സയൻസിൽ സിആർഡിയും എക്സ് പോസ്റ്റ് ഫാക്ടോ ഡിസൈനും 50 ശതമാനം എന്ന രീതിയിൽ ഉപയോഗിച്ചതായി കണ്ടെത്തി . ഏഴ് വിഭാഗങ്ങൾക്ക് കീഴിൽ സ്ഥിതിവിവരക്കണക്ക് രീതികളെ തരംതിരിച്ചപ്പോൾ വിള ഉൽപാദനത്തിലെ ഭൂരിഭാഗം പഠനങ്ങളിൽ പാരാമെട്രിക് പരിശോധന രീതികളും (61.54%), വിള സംരക്ഷണത്തിൽ അടിസ്ഥാന സ്ഥിതിവിവരക്കണക്കുകളും (47.72%), വിള മെച്ചപ്പെ ടുത്തൽ വിഭാഗത്തിൽ അടിസ്ഥാനപരമായ പരിശോധന രീതികളും (33.33%) സാമൂഹ്യ ശാസ്ത്രത്തിൽ സ്ഥിതിവിവരക്കണക്കുകളും (59.26%), കമ്മ്യൂണിറ്റി സയൻസിൽ പാരാമെട്രിക് ടെസ്റ്റുകളും രീതികളും (35.30%)ഉപയോഗിച്ചതായി കാണാൻ കഴിഞ്ഞു . സാമ്പിൾ പരിശോധിക്കുമ്പോൾ കമ്മ്യൂണിറ്റി സയൻസയിലെ ഭൂരിഭാഗം പ്രബന്ധങ്ങളിലും (50%) ഇത് നൂറിൽ താഴെയായി കാണപ്പെട്ടു. സാമൂഹ്യ ശാസ്ത്രം ഒഴികെയുള്ള എല്ലാ ഡിവിഷനുകളിലെയും ഭൂരിഭാഗം പ്രബന്ധനങ്ങളിലും സാമ്പയിളിന്റെ എണ്ണം 101-200 വരെയായപ്പോൾ സാമൂഹ്യ ശാസ്ത്രം (60.00%) വിഭാഗത്തിൽ ഇത് 201-300 നിലയിൽ കാണപ്പെട്ടു . സാമ്പിൾ ശേഖരിക്കുന്ന രീതികളുടെ കാര്യത്തിൽ ഭൂരിഭാഗം (40.00%) പ്രബന്ധനങ്ങളിലും റാൻഡം സാമ്പിൾ ഉപയോഗിച്ചതായി കാണപ്പെട്ടു. സാമൂഹ്യ ശാസ്ത്ര വിഭാഗമായ വിജ്ഞാന വ്യാപന ബന്ധിത പ്രബന്ധനങ്ങളിൽ ഭൂരിഭാഗത്തിലും (75.00%) ഏകദേശം 9-30 സ്വതന്ത്ര വേരിയബിളുകൾ പഠിച്ചതായി കാണാൻ കഴിഞ്ഞു.

പ്രസിദ്ധീകരണങ്ങളുടെയും ഉദ്ധരണികളുടെയും അനുപാതത്തെ അടിസ്ഥാനമാക്കിയാണ് അക്കാദമിക് ഗവേഷണ ഉൽപ്പാദനക്ഷമത വിലയിരുത്തിയത്. ഡാറ്റ പരിശോധിച്ചപ്പോൾ, വിള ഉൽപാദന വിഭാഗം ശരാശരി രണ്ട് പേപ്പറുകൾ പ്രസിദ്ധീകരിക്കുകയും (42.42%), കമ്മ്യൂണിറ്റി സയൻസിൽ നടന്ന പകുതിയോളം പഠനങ്ങളും രണ്ടിൽ കൂടുതൽ പേപ്പറുകൾ (50.00%) പ്രസിദ്ധീകരിക്കുകയും ചെയ്തതായി കണ്ടെത്തി. ചുരുക്കത്തിൽ, 39.19 ശതമാനം എന്ന നിലയിൽ രണ്ടിൽ താഴെയുള്ള പ്രസിദ്ധീകരണങ്ങളാണ് ഏറ്റവും കൂടുതലായി കാണപ്പെട്ടത്. പിയർ റിവ്യൂ ചെയ്ത ജേണലുകളിലെ പ്രസിദ്ധീകരണങ്ങളെ വ്യത്യസ്ത സൂചിക ലിസ്റ്റുകൾക്ക് കീഴിൽ തരംതിരിച്ചിട്ടുണ്ട്. അവിടെ ഭൂരിഭാഗം പ്രസിദ്ധീകരണങ്ങളും (82.42%) നാഷണൽ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് അഗ്രികൾച്ചറൽ സയൻസസ് (NAAS) റേറ്റഡ് ജേണലുകളുടേതാണെന്ന് ശ്രദ്ധിക്കപ്പെട്ടു, തുടർന്ന് ഗൂഗിൾ സ്കോളർ (12.12%), കോപ്പർനിക്കസ് സൂചിക (2.42%), മറ്റുള്ളവ (2.42%), യൂണിവേഴ്സിറ്റി ഗ്രാന്റ്സ് കമ്മീഷൻ - കൺസോർഷ്യം ഫോർ അക്കാദമിക് റിസർച്ച് ആൻഡ് എത്തിക്സ് (UGC-CARE) ലിസ്റ്റ് (1.21%), സ്കോപ്പസ് ഇൻഡക്സ് (0.61%) എന്ന രീതി കാണപ്പെട്ടു . ഉദ്ധരിക്കപ്പെട്ട പ്രബന്ധങ്ങളിൽ ഭൂരിഭാഗവും (84.05%) 1991-ലും അതിനുമുകളിലും ഉള്ളവയാണെന്ന് വർഷത്തെ അടിസ്ഥാനമാക്കിയുള്ള അവലംബ വിതരണം കാണിക്കുന്നു, എന്നാൽ ഉറവിടത്തെ അടിസ്ഥാനമാക്കി തിരിച്ചറിഞ്ഞ 35 തരം സ്രോതസ്സുകളിൽ, എല്ലാ ഡിവിഷനുകളിലും ഭൂരിഭാഗം ജേണലുകളും ഉദ്ധരിക്കപ്പെട്ടതായി കണ്ടെത്തി. പുസ്തകങ്ങൾ, നടപടിക്രമങ്ങൾ, മാസ്റ്റർ ഓഫ് സയൻസ് (എം.എസ്.സി.) തീസിസുകൾ, ഡോക്ടർ ഓഫ് ഫിലോസഫി (പി.എച്ച്.ഡി.) തീസിസുകൾ, ഇ-റിസോഴ്സുകൾ എന്നിവയാണ് ഉദ്ധരിച്ച മറ്റ് പ്രധാന ഉറവിടങ്ങൾ. കാർഷിക വിപുലീകരണം ഒഴികെയുള്ള എല്ലാ വകുപ്പുകളിലും ദേശീയ പ്രസിദ്ധീകരണങ്ങളുമായി താരതമ്യപ്പെടുത്തുമ്പോൾ അന്തർദേശീയ പ്രസിദ്ധീകരണങ്ങൾ കൂടുതലായി ഉദ്ധരിക്കപ്പെട്ടതായി ഉദ്ധരണികളുടെ

ഭൂമിശാസ്ത്രപരമായ വിതരണം സൂചിപ്പിച്ചു. എല്ലാ വകുപ്പുകളിലും, ദേശീയ-അന്തർദേശീയ പ്രസിദ്ധീകരണങ്ങളിൽ നിന്നുള്ള ഉദ്ധരണികളുടെ ശരാശരി എണ്ണം കമ്മ്യൂണിറ്റി സയൻസിൽ യഥാക്രമം 217, 416 എന്നിങ്ങനെ ആണ്. അവലംബങ്ങളുടെ ശരാശരി എണ്ണത്തിൽ, ജനിതകശാസ്ത്ര വിഭാഗത്തിൽ ഏറ്റവും ഉയർന്ന ശ്രേണി (272-843) കണ്ടെതത്തിയപ്പോൾ , കമ്മ്യൂണിറ്റി സയൻസ് വിഭാഗത്തിൽ (633) 448-827 ശ്രേണിയിൽ അവലംബങ്ങളുടെ ശരാശരി എണ്ണം ഏറ്റവും കൂടുതലായി നിരീക്ഷിക്കപ്പെട്ടു.

പിഎച്ച്ഡി ഗവേഷണത്തോടുള്ള വിദ്യാർത്ഥികളുടെ മനോഭാവം പഠിക്കുകയുണ്ടായി. 74.00 ശതമാനം വിദ്യാർത്ഥികൾക്കും നല്ല മനോഭാവം ഉള്ളതായും 16.00 ശതമാനം വിദ്യാർത്ഥികൾക്ക് പിഎച്ച്ഡി ഗവേഷണത്തോട് വളരെ നല്ല മനോഭാവം ഉള്ളതായും കണ്ടെത്തി. 86.67 ശതമാനം അധ്യാപകരും വിദ്യാർത്ഥികൾക്ക് ഗവേഷണത്തോട് നല്ല മനോഭാവം ഉള്ളതായും 13.33 ശതമാനം അധ്യാപകരും വിദ്യാർത്ഥികൾക്ക് ഡോക്ടറൽ ഗവേഷണത്തോട് വളരെ നല്ല മനോഭാവമുള്ളതായും തിരിച്ചറിഞ്ഞു. മൊത്തത്തിൽ, ഗവേഷണ വിഷയങ്ങളെ അടിസ്ഥാനമാക്കിയുള്ള പര്യാപ്തതയുടെ കാര്യത്തിൽ, കേരളത്തിലെ കാർഷിക പ്രശ്നങ്ങളെ അഭിമുഖീകരിക്കുന്നതിൽ 23.40 ശതമാനം വിടവ് ഉണ്ടെന്ന് അധ്യാപകർ അഭിപ്രായപ്പെടുകയും, വിദ്യാർത്ഥികൾ 32.20 ശതമാനം വിടവ് അഭിപ്രായപ്പെടുകയും ഉണ്ടായി. വിദ്യാർത്ഥികളുടെ അഭിപ്രായത്തിൽ ഡോക്ടറൽ ഗവേഷണം നടത്തുന്നതിനുള്ള പ്രധാന തടസ്സങ്ങൾ അപര്യാപ്തമായ ഫണ്ട് (റാങ്ക് 1), നൂതന ഗവേഷണ സൗകര്യങ്ങളുടെയും ഉപകരണങ്ങളുടെയും അഭാവം (റാങ്ക് 2), മതിയായ ലാബ് സൗകര്യങ്ങളുടെ അഭാവം (റാങ്ക് 3) എന്നിവയാണ്. അപര്യാപ്തമായ ലാബ് സൗകര്യങ്ങൾ (റാങ്ക് 1), നൂതന ഗവേഷണ സൗകര്യങ്ങളുടെയും ഉപകരണങ്ങളുടെയും അഭാവം (റാങ്ക് 2), അപര്യാപ്തമായ ഫണ്ട് (റാങ്ക് 3) എന്നിവയാണ് അധ്യാപകർ പരിമിതികളായി കണ്ടത്. കേന്ദ്ര ഇൻസ്ട്രുമെന്റേഷൻ സൗകര്യം, കണ്ടിജന്റ് ഗ്രാന്റുകൾ/ഫണ്ടുകൾ വർധിപ്പിക്കൽ, ബാഹ്യ സഹായ പദ്ധതികളിൽ പങ്കാളിത്തം, നൂതന രീതികളിലേക്കോ ഉപകരണങ്ങളിലേക്കോ വിദ്യാർത്ഥികളെ എക്സ്പോഷർ ചെയ്യൽ, ഇന്റർ ഡിസിപ്ലിനറിയിലോ മറ്റ് സ്ഥാപനങ്ങളിലോ ഗവേഷണ സഹകരണം നടപ്പിലാക്കൽ ഇൻസ്റ്റിറ്റ്യൂട്ടുകളിലും (ദേശീയമോ വിദേശമോ), കോൺഫറൻസുകളിലും സെമിനാറുകളിലും (ദേശീയമോ അന്തർദേശീയമോ) വിദ്യാർത്ഥികളെ പങ്കെടുപ്പിച്ച് പരമാവധി എക്സ്പോഷർ നൽകൽ, ഗവേഷണം നടത്തുന്നതിന് മുമ്പ് അവരുടെ അറിവും നൈപുണ്യവും വർദ്ധിപ്പിക്കുന്ന പ്രഭാഷണങ്ങൾ പ്രായോഗിക ക്ലാസുകൾ സംഘടിപ്പിക്കൽ, ശരിയായ പരിശീലനം നൽകൽ എന്നിവയാണ് ഈ പരിമിതികൾ മറികടക്കാൻ അധ്യാപകർ നിർദ്ദേശിച്ച മാർഗ്ഗങ്ങൾ. അക്കാദമിക് ഗവേഷണ ഉൽപ്പാദനക്ഷമത മെച്ചപ്പെടുത്തുന്നതിന്, ഉയർന്ന NAAS റേറ്റിംഗുകളും (6+ ഇംപാക്ട് ഫാക്ടർ) മറ്റ് സമാന സൂചികകളുമുള്ള പിയർ റിവ്യൂഡ് ജേണലുകളിൽ കൂടുതൽ ഗുണനിലവാരമുള്ള ലേഖനങ്ങൾ പ്രസിദ്ധീകരിക്കാൻ വിദ്യാർത്ഥികളെ പ്രോത്സാഹിപ്പിക്കുകയും വ്യവസ്ഥാപിതമായി നിരീക്ഷിക്കുകയും അവലോകനം ചെയ്യുകയും ചെയ്യുന്ന പ്രസിദ്ധീകരണങ്ങളിൽ പ്രസിദ്ധീകരിക്കുവാൻ ഉതകുന്ന കണ്ടെത്തലുകൾ നല്കുന്ന ഗവേഷണം നടത്തുവാൻ പ്രേരിപ്പിക്കുകയും ചെയ്യേണ്ടത് അനിവാര്യമാണ്.